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PUBLIC WORKS

CITY COUNTY STATE

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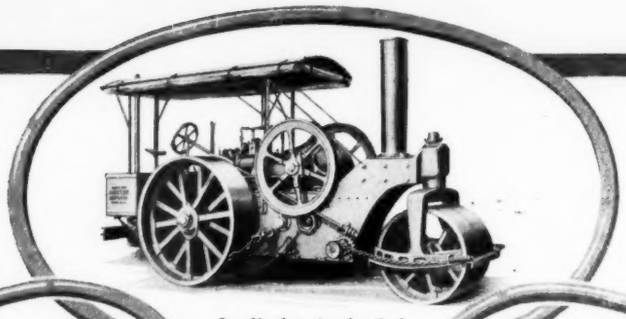
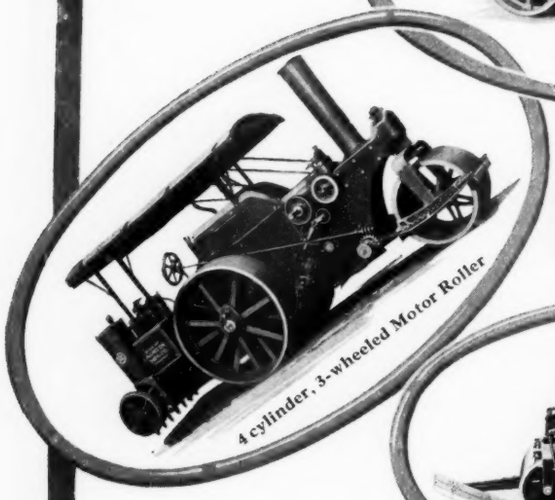


2 cylinder, 3-wheeled Motor Roller



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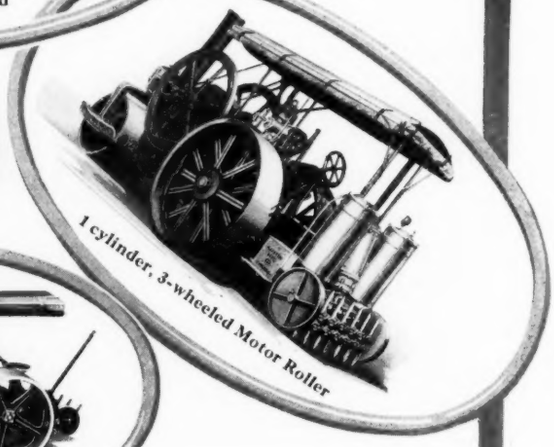
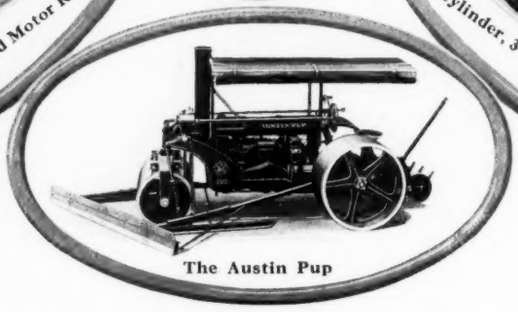


1 cylinder, 3-wheeled Motor Roller



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4 cylinder TANDEM			√	√	√	√			
1 cylinder 3-WHEELED					√	√	√	√	√
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4 cylinder 3-WHEELED							√	√	√

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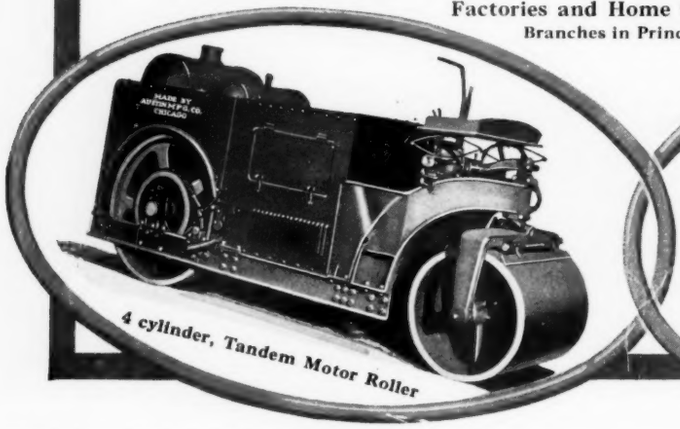

4 cylinder, Tandem Motor Roller

2 cylinder, Tandem Motor Roller

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PUBLIC WORK
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A Combination of "MUNICIPAL JOURNAL" and "CONTRACTING"

Vol. 55 September, 1924 No. 9

Buffalo's New Filtration Plant

Largest rapid sand filter plant in the world nearing completion. Some of the more interesting features of the plans described. Built on land reclaimed from the lake; foundations twenty feet below lake level.

By George C. Andrews*

The city of Buffalo is rapidly completing the first section of what will eventually be the largest individual filter plant in America, having a total maximum capacity of 480 million gallons of water per day. This plant will be of the rapid sand mechanical type.

In 1921, after a four-year intensive water waste prevention campaign, as a result of which the per capita consumption was reduced from 339 gallons per day to less than 220 gallons, the city authorities considered it advisable to construct a filter plant; and as a result of a referendum held that Fall on the question, the Bureau of Water was authorized to prepare plans for and construct a 160 million gallon plant at an estimated cost of $4,000,000.

The entire water supply of Buffalo is furnished by two pumping stations located on the shores of the Niagara river about 4,000 feet apart, and the water is taken from an intake located at the head of the Niagara river which is 6,300 feet from the Ward pumping station. The intake is connected with the shore by a concrete-lined tunnel

*Water Commissioner and Engineer of Filtration Division.

GENERAL VIEW OF FILTER PLANT UNDER CONSTRUCTION.
Looking southwest. Shows column footings and walls of clear-water reservoir, and excavation for clear-water conduit. Taken September 1, 1923.

12 feet square driven through the rock underneath the river, and the water is carried from Ward station to the Massachusetts Avenue pumping station through a similar concrete-lined rectangular tunnel, 8 x 9 feet in section.

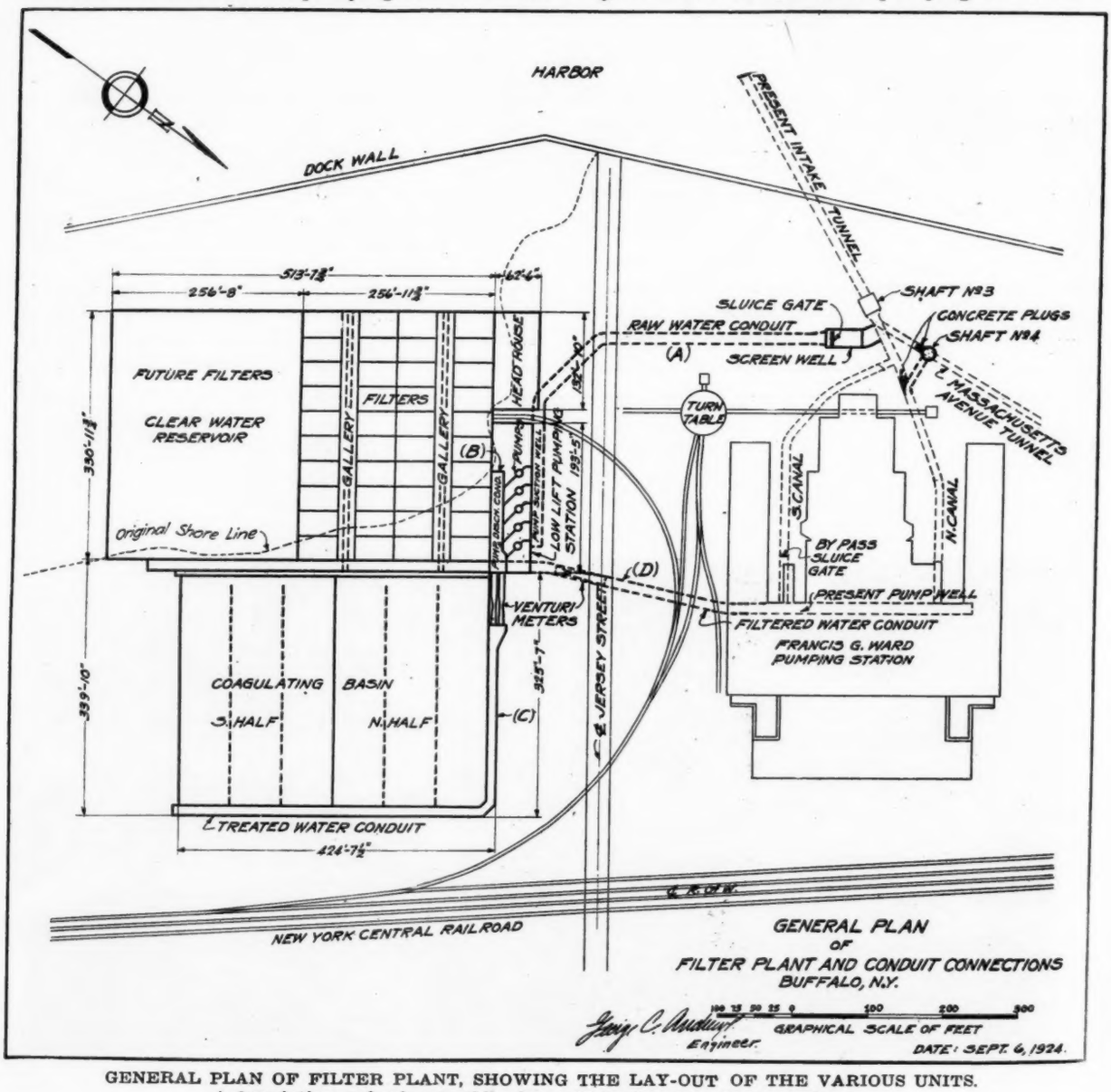
The Ward pumping station is equipped with five 30 m.g.d. triple expansion engines and has space for three additional units; and the Massachusetts Avenue pumping station is equipped with six 30 m.g.d. engines; which gives a total combined daily capacity of 330 m.g.d., with a possible future increase at the Ward pumping station of 90 m.g.d.

The city water consumption is now under such control that a plant with a normal capacity of 160 m.g.d., which will allow a 50 per cent. overload on the filters for a short period, is considered ample for a number of years; but in design of the conduits and low-lift pumping station it was taken into consideration that at some future time additional water would be needed and it would be desirable to make the filter plant in this location of sufficient size to handle the ultimate capacity of both pumping stations, wherefor all conduits have been designed for a maximum flow of 480 m.g. per day.

PLANNING THE FILTRATION PLANT

The determining features in the arrangements of the units which make up the filtration plant were its location with relation to the Ward pumping station and the intake conduits from the lake to this station, and the necessity of having filtered water reach the pumps of the stations at approximately lake level, elevation 572.8. The Ward pumping station being the main pumping plant for the city, it was most economical to place the filtration plant adjacent to it.

Just south of the Ward pumping station and



GENERAL PLAN OF FILTER PLANT, SHOWING THE LAY-OUT OF THE VARIOUS UNITS.
A description, referring to this plan, will be found on the opposite page.

adjoining the Government ship canal there is an old city dump, and in 1921 the city built a concrete retaining wall resting on piers and rock filled cribs along the harbor lines which made available an area of 30 acres—approximately half of which were under water.

The area covered by the filter plant is roughly 600 feet x 700 feet, or 9 acres. By arranging the coagulating basin on the east and the clear water reservoir at the west, with the filtered water conduit running north and south between them, it was possible to use the material excavated from the coagulating basin behind the new dock wall and form an embankment at the west of the wall from 120 to 230 feet wide, which was ample to protect the work from the river during construction.

EXCAVATION FOR CLEAR-WATER RESERVOIR EMBANKMENT BUILT AGAINST DOCK WALL AT RIGHT. Taken May 1, 1923.

The plant as laid out consists of a low-lift pumping station, 193 feet x 49 feet; coagulating basin, 410 feet x 304 feet; a filtered water reservoir, 513 feet x 327 feet; and a head house, containing the offices and chemical feed apparatus and chemical storage room, laboratories, etc., 132 feet x 62 feet; with a raw-water conduit, 688 feet long and 12 feet square section; and a filtered-water conduit connecting the resorvoir with the intake well of the Ward pumping station, 724 feet long and 12 feet square section.

The elevation of the ground and the elevation of the underlying rock determined the type of foundations. Preliminary borings on the site showed that the underlying rock was at an average elevation of 554 feet above sea level, while the ground level on the site was approximately 32 feet above this level, so that an economical arrangement of the clear-water reservoir was to utilize the rock for the floor of this reservoir; and as the water is filtered by gravity, the filter boxes were placed directly over the filtered water reservoir. Since the capacity of the filters is 160 million gallons per day, and it was thought that a 3-hour period of sedimentation in the coagulating basin was sufficient, the coagulating basin was designed on the basis of 20 million gallons capacity.

The rock underlying the coagulating basin is at an average elevation of 550, and since the level of water necessary to produce the head for filtration was 587 above sea level, the floor and walls of the coagulating basin were designed to meet this condition.

The climate in Buffalo makes it desirable to use a covered coagulating basin to prevent excessive ice formation in the Winter and algae growths in the Summer. The depth of the coagulating basin, therefore, is such that reinforced concrete walls supported at the top and bottom was the most economical design. The reaction at the top of these walls is carried across the roof of the basin and that at the bottom is taken by dowelling the walls into the rock.

As it is necessary to periodically drain the coagulating basin, the floor of the basin was formed within walls on top of an underlying layer of clay, which averages about 4 feet and provides space for under-drain pipes.

The general plan of the filtration plant is shown in the accompanying drawings, by referring to which can be traced the course of the water through the plant. The raw water comes in through conduit marked "A" at lake level, average elevation 572.8. It is pumped from this level, by electrically operated centrifugal pumps in the low-lift pump station, into the discharge conduit marked "B" on the sketch, to an elevation of approximately 587, which is high water in the coagulating basin. This discharge conduit from the pumping station runs along the north and east side of the coagulating basin and is known as the "treated water conduit," designated as "C". The east conduit discharges through sluice gates and over a wier into the basin, the purpose of this wier being to evenly distribute the flow across the basin. This basin is provided with upper and lower baffle walls to facilitate mixing.

The coagulating basin is divided into two sections so that one-half may be drained for cleaning while the other half is in operation. Each section is subdivided by so-called "training walls"

PIPE GALLERY AND PIPES READY FOR LAYING. CONCRETE FILTER BOXES AT THE SIDES.
In the background, towers carrying construction cables. Photographed September 1, 1924.

for the purpose of preventing cross currents or "short circuiting" of currents in the basin. In other words, these walls provide a uniform flow.

One of the features of this plant is the omission of a separate mixing chamber. This was omitted on account of the fact that the turbidity of the raw water is low, ranging from zero to 250 p,p,m., and also because the coagulant is applied in the raw-water conduit before it passes through the low-lift pumps, where it is expected that these centrifugal pumps will provide sufficient mixing of the coagulant.

The coagulated water passes out of the coagulating basin through a skimming wier extending the whole length of the west side of the basin. From there it is collected in the filtered water conduits, from where it passes through a concrete conduit down the center of the filter galleries. From this conduit it is distributed to the filter tanks and the flow controlled by hydraulically operated valves. The filter tanks are superimposed over the filtered-water reservoir and the filtered water passes from the tanks into the reservoir through Venturi type controllers by which filtration is regulated at any desired rate.

As stated elsewhere in this article, the normal capacity of the plant is 160 million gallons. The filter units are made up of forty 4-million gallon tanks. The normal capacity may be increased by a fifty per cent. overload if required. The arrangement of the filter units is shown in the accompanying plan. They are placed in rows of ten filters each on both sides of the filter galleries. The operating floor of these filter galleries will be at the same level as the top of the filter tanks. Each filter will be provided with a separate operating table placed on the operating floor and all the controlling mechanism for operating the filters will be placed on these tables.

After the water passes from the filter tanks into the filtered water reservoir, which has a capacity of about 18 million gallons, it enters the filtered-water conduit (shown as "D" on drawing) through eight 4-foot square sluice gates so arranged that the flow may be controlled to prevent any portion of the reservoir becoming stagnant. This filtered-water conduit carries the filtered water into the Ward pumping station at practically lake level.

The filtered water reservoir is divided into five separate chambers, any one of which may be pumped out for short periods of time for cleaning without closing down the entire plant.

A head house or coagulant house placed just west of the low-lift pumping station is provided for general offices, storage and application of chemicals, and on the third floor of this building will be placed two concrete wash-water tanks. These wash-water tanks supply filtered water for washing the filters. They may be filled either by wash-water pumps placed in the low-lift pumping station or from the city water supply. Under ordinary conditions the wash-water pumps will be used for this purpose, since the city water supply is furnished at an unnecessarily high pressure, and this connection will be used in an emergency only.

The low-lift pumps for furnishing the necessary head of water or gravity flow through the filtration plant will be electrically operated centrifugal pumps. They will consist of two 75-million gallon units, one 45, one 30, and one 15-million gallon unit. As it becomes necessary to increase the capacity of the filtratoin plant the smaller units will be replaced by larger pumps, and the foundations and connections of all these pumps are designed to meet this future requirement. The pumps are placed below lake level in the low-lift pumping station so that they will not require priming. Power for the operation of these pumps will be obtained from the Buffalo General Electric Company, as it can be purchased at a lower rate than it can be produced by the city.

Venturi meters will be used on the raw-water conduit and the filtered-water conduit and will be connected to indicating and recording gauges by which the operation of the filtration plant will be controlled in respect to the application of coagulant and chlorine. These meters are constructed of concrete. There are two raw-water meters having a 48-inch diameter throat and 72-inch diameter discharge. The filtered water meter is 12 feet square with a 6-foot square throat, this being the largest meter of this type ever installed in a filtration plant.

One of the interesting features in the design of this filtration plant is making the connections between the present intake tunnels and the raw and filtered-water conduits. These connections must be made without interference with the city water supply. As will be seen in the accompanying plan, filtered water will be furnished into the south end of the present pump well in the Ward pumping station instead of as at present through the north and south canals which supply raw water into the pump well. In addition to this it will be necessary to furnish filtered water to the Massachusetts Avenue station, which at present is fed through a concrete-lined tunnel which forms an extension to the present intake tunnel. In making this connection it will be necessary to sink a 10-foot diameter shaft and cut into the top of this tunnel.

(To be continued)

Concrete Pavements for City Streets

Not considered suitable for most streets in New York City because of difficulty of repaving over cuts. Costs as much as sheet asphalt.

The charter of Greater New York provides that pavements paid for by assessment be classified as either permanent or preliminary, the latter intended to be used as a cheap form of pavement for streets where a high-priced pavement was not justified owing to low property values and lack of subsurface structures. When the street development warrants, the preliminary is replaced with a permanent pavement, the differ-

ence in cost to be assessed against the property. Some years ago the Board of Estimate designated Portland cement concrete as a preliminary pavement, but in 1922 was asked to reclassify it as "permanent." In his latest annual report to the Board of Estimate, Herman H. Smith, deputy chief engineer, discussed the matter as follows:

"While it has not been demonstrated that concrete pavements will give as good service as either sheet asphalt or granite block on heavy or even medium traffic streets in the City of New York, such pavements have given satisfactory service elsewhere, particularly on State roads, and in some cases under severe traffic conditions and their value as high-class pavements under certain conditions is generally conceded. Aside, however, from all questions as to their ability to successfully withstand the effects of traffic, their structure is such as to make them less adaptable than either sheet asphalt or granite block pavement to certain other important requirements necessary to make a successful pavement for a city street, and their general use, therefore, throughout the city would not be advisable.

"Great precautions are now used to see that subsurface structures are installed before new pavements are laid, but experience has shown that notwithstanding these precautions the opening of pavements cannot be avoided. In many cases new pavements are laid on streets which are not fully developed and the development of the balance often necessitates many openings for subsurface connections, and, in addition, such openings are often required for the purpose of making repairs to such structures and for making extensions of subsurface facilities which may not be warranted at the time the pavement is laid. It is necessary, therefore, to take into consideration the question of repairs.

"A sheet asphalt pavement is readily repaired. The material forming the surface patch is laid at a high temperature and forms a close bond with the adjoining old material. Such patches can be laid so that they are almost invisible after they have been subjected to traffic for a short time providing there is no settlement of the foundation. The same thing is true of a patch in granite block pavement and in both cases the patches can be opened to traffic almost as soon as they have been completed, which is a very important consideration when dealing with streets where there is considerable traffic congestion.

"A Portland cement concrete pavement is not readily repaired. It is extremely difficult to patch these pavements in such a way as to obtain a close bond between the old and new work and the patches are plainly visible, thus detracting from the appearance of the street. In addition, traffic must be kept off the concrete patches for ten days or two weeks after they are laid in order that the concrete may set, thus practically prohibiting their use on any street where there is vehicular congestion.

"A permanent concrete pavement should be from seven to eight inches in thickness. It should be reinforced with about 65 pounds steel reinforcement per 100 square feet. The mixture should consist of one part of cement, one and one-half parts of sand and three parts of stone, and a pavement of this kind at present prices would cost at least $3.50 per square yard. The cost of sheet asphalt pavement on a six-inch concrete foundation at present prices is also about $3.50 per square yard, so that no saving in first cost would be effected by the admission of concrete pavements as permanent pavements.

"The purpose which the classification of pavements was designed to accomplish was to enable the city to provide a cheap form of pavement for streets where a high-priced pavement was not justified owing to low property values and the lack of subsurface structures. The preliminary pavement for which the Charter provides is intended to be used to meet such conditions and to serve as a temporary expedient until such time as the laying of a permanent pavement is justified. The law specifically provides, however, that when a preliminary pavement is replaced by a permanent pavement the difference in cost shall be paid for by assessment. Having in mind the purpose of the law, it would appear that a concrete pavement should not be classified as a preliminary pavement owing to its high first cost and the fact that it is not of a temporary nature and is unsuited for use in cases where it must subsequently be opened for the purpose of installing subsurface structures.

"In order to overcome some of these objections it has been proposed to lay preliminary concrete pavements three inches below grade with the idea of later using them as a foundation for sheet asphalt pavement. While this may be done in such cases where surface drainage can be provided, it would not be good practice because such pavements would make a very expensive foundation, the usefulness of which would be largely destroyed by openings made for installing subsurface structures. The stability of the foundation under the pavement is the most important factor in maintaining a pavement in good condition and it would appear to be false economy to lay a new pavement on a foundation whose usefulness may have been seriously impaired by the installation of extensive subsurface work necessitating the removal and replacement of a large part of such foundation. It is further apparent that a concrete pavement laid as a foundation would cost more than the asphalt top and that therefore no further assessment could be levied at the time when a preliminary concrete pavement so laid is converted into a permanent pavement by covering it with an asphalt top.

"The facts stated indicate that concrete pavements should not be designated as preliminary pavements. They are well suited as permanent pavements for suburban roads and there are undoubtedly many streets where their use would be desirable."

Public Improvements in Oak Park, Ill.

Widening of roadways of several streets to provide for increased traffic. Some of the engineering features and costs. Benefits derived from improvements.

By Dudley C. Meyers*

The improvement of Madison Street in Oak Park, Illinois, by widening and repaving the roadway and by installing a system of ornamental post lights, is one that presents many interesting features.

Madison Street is a main highway leading westward from the city of Chicago. Through Oak Park its width between lot lines is 120 feet, from Austin Boulevard to Oak Park Avenue, one mile, and from Oak Park Avenue to Harlem Avenue, one-half mile, is 66 feet. The central 16 feet of the street is occupied by the tracks of the Chicago & West Towns Railway Company.

The street was originally improved in 1897 with a cedar block pavement 52 feet wide. It was repaved in 1907 with brick pavement 46 feet wide. When it was repaved there was opposition from some of the property owners to repaving for a width of 52 feet. One objection raised was that "Madison Street was nothing but a country highway, that it would never be anything else and that a width of 52 feet was excessive." A compromise width of 46 feet was agreed upon, and the street was paved with a brick pavement on 15-inch macadam foundation. This pavement was in good shape in 1922, but increased traffic and development of the business property abutting the street made it desirable to repave and widen the roadway.

The property owners along the street organized an improvement association and, cooperating with the village officials, originated an improvement for widening and repaving the roadway from Austin Boulevard to Oak Park Avenue to a width of 76 feet and to install an ornamental system of street lights from Austin Boulevard to Harlem Avenue. It was not possible to widen the roadway west of Oak Park Avenue on account of the width of the street between property lines.

*Commissioner of Public Works, Oak Park, Ill.

MADISON STREET, OAK PARK, NOT YET WIDENED.
Roadway 46 feet wide, two lines of car tracks.

MARION STREET, OAK PARK, BETWEEN NORTH BOULEVARD AND LAKE STREET.
Business center and very busy section. Thirty feet between curbs. Numerous accidents due to vehicles trying to pass each other with cars parked on both sides.

The improvement provided for repaving with brick pavement. The old bricks between the existing curb lines were taken up carefully, culled and cleaned, and it was possible to use about 60 per cent. of them on the new improvement. The old 15-inch macadam base under the brick pavement was found to be compacted and in good condition. This was reshaped where necessary and surfaced with a 4-inch Portland cement concrete foundation.

On the portion of the roadway outside of the old roadway, a 7-inch concrete base was constructed. The mix of the concrete on the entire foundation was 1-2½-5. Special care was given to the construction of the concrete base over the joint along the edge of the macadam.

On the concrete base was spread a sand cushion of 1½ inches and on this was placed the brick wearing surface. The old brick which had been saved from the former pavement was used in the portion of the street commencing at the curb line and extending as far toward the center of the roadway as was possible. The joints between the brick were filled with an asphalt filler and the surface of the street then covered with a half-inch of sand. The brick pavement on the portion of the street occupied by the street railway was repaired and relaid. A Portland cement limestone concrete combined curb and gutter was constructed along the sides of the roadway.

MADISON STREET, OAK PARK, WIDENED TO 76 FEET.

The total cost of the paving was $191,500. Unit prices were:

Combined curb and gutter	$1.10 per lin. ft.
Excavation and grading	1.35 per cu. yd.
Relaying brick pavement on 4" of concrete	2.04 per sq. yd.
New brick pavement on 4" of concrete	4.05 per sq. yd.
New brick pavement on 7" of concrete	4.84 per sq. yd.

In addition to the above there was a considerable amount of miscellaneous sewer work done in adjusting manholes and catch basins. All steps at street corners were eliminated.

At the time the pavement was laid the street railway company removed all of the old wooden poles on the street and replaced them with steel poles.

At the same time a system of ornamental post street lights was installed. The street lighting system covered the entire street from Austin Boulevard to Harlem Avenue, a distance of a mile and a half. A parkway cable was installed just back of the curbing. There were 184 lamp posts. These were 12 feet 6 inches high, were equipped with ball globes and 250 candle-power lamps, and spaced about 100 feet square, 129 of these lights burning all night and 55 of the lights burning until 11 P. M. The total cost of the street lighting system was $39,653. Upon the completion of these improvements the business men had a special evening celebration for the official opening of the street.

The Madison Street improvement was the outstanding feature of the work done in 1923, but in addition to this there were other widening projects. The roadway of Oak Park Avenue from Pleasant Street to South Boulevard was widened from thirty feet to forty-two feet, and Wisconsin Avenue from Pleasant Street to South

MARION STREET, OAK PARK, BETWEEN SOUTH BOULEVARD AND PLEASANT STREET.
Widened from 32 feet to 42 feet. Allows diagonal parking on one side, straight parking on the other, and plenty of room for two lines of moving traffic.

Boulevard from thirty-two feet to forty-two feet. Both of these streets were formerly paved with macadam about fifteen inches thick. These old pavements had been in place for about 15 years but were in good condition except for small depressions in the surface.

The widening and repaving of these streets was accomplished by reshaping the central 24 feet of the pavement, depressions being filled in with binder course. On the three feet adjoining the old gutters the macadam was reshaped. Over this macadam was placed a concrete base five and one half inches thick. On the widened portion between the old and new curb lines was placed a Portland cement concrete foundation seven inches deep. On this foundation was placed a sheet asphalt pavement consisting of a two-inch asphalt wearing surface on a one and one-half inch binder course. The total cost of widening and repaving on Wisconsin Avenue was $12,788.31 and on Oak Park Avenue, $13,673.79. The unit prices were:

Concrete combined curb and gutter on 6" of cinders	$1.21 per ft.
Excavation and grading	2.25 per cu. yd.
Asphalt pavement on concrete base 5½" in depth	3.60 per sq. yd.
Asphalt pavement on concrete foundation 7" in depth	3.91 per sq. yd.
Asphalt pavement over old macadam	2.83 per sq. yd.

At the present time the Village of Oak Park has extensive improvements under way for widening, repaving and new improvements. An ordinance for repaving and widening Lake Street from Oak Park Avenue to Austin Boulevard, a distance of one mile, is now pending in court. This improvement provides for widening the roadway from 38 feet to 50 feet and for repaving by removing the old brick pavement and resurfacing with sheet asphalt over old macadam and new concrete base. The total estimated cost of this improvement is $139,000. Plans are being prepared for widening Lake Street, from Oak Park Avenue to Harlem Avenue, a distance of one-half mile.

The widening and repaving of these streets has been of great benefit to the abutting property and to the community at large. The widening provides for additional space for parking of cars and also accommodates moving traffic. Where pavements have been widened, the improvement has affected the character of the development of the property abutting the streets.

In all cases where widening and repaving has been done, it has been noted that the construction of new buildings and remodeling of old buildings has been encouraged. It is also interesting to note that these widening projects followed very closely the zoning of certain districts for a specified use. Since the widening and repaving of these streets, petitions have been presented for similar improvements in other parts of the village, and ordinances are now pending in court for the same.

At the present time public improvements in progress in Oak Park are as follows:

Ordinances for new street improvements pending in court aggregate $491,384.50 estimated cost.

Ordinances for alley improvements constructed to date and in progress at the present time aggregate $225,012.50 estimated cost.

Ordinances for sewer systems pending in court aggregate $281,493.00.

Ordinances for water systems now pending in court aggregate $70,000.

The village has also just voted on a bond proposition to construct a 5,000,000 gallon reservoir at an approximate cost of $200,000.

Chicago Street Improvement Projects

Of the ten major projects of the Chicago Plan Commission only one, the Michigan boulevard link bridge with the widening of Michigan avenue, is completed. The other nine involve a total expenditure of $94,562,000.

The Chicago Plan includes the development of a quadrangle of wide streets around the central business district; provision for additional entrances to and exits from the loop, and the development of a complete system of major through streets to be officially adopted by the city.

Within a few weeks work will start on the South Water street improvement, the second of the quadrangle and the necessary link to connect the new Michigan avenue with the new Canal street.

Widening of LaSalle street is one of the big improvements not included in the ten major projects of the Chicago Plan Commission. The Board of Local Improvements estimates that the cost of this widening from Washington street to Ohio street, including the necessary bridge across the river, will be $11,000,000, but the Chicago Plan Commission insists that for $4,000,000 additional the improvement can be carried through to Lincoln Park and thus do away with a "bottle neck" which would be created were the widening to stop at Ohio street.

In addition the Board of Local Improvements has under consideration and in various stages of progress the improvement of 110 miles of streets, the paving of forty miles of alleys, thirty miles of sewer improvements, ranging from twelve inches to twelve feet in diameter; sixty miles of water mains, about 40,000 private drains and several score street widening and street opening projects.

The work of extending the general water distribution system has been planned for the next fifteen years at an annual cost of $900,000, or $13,500,000 for the fifteen years. The new Western avenue station, on which $1,500,000 is being spent this year, will cost $2,700,000, and the tunnel system to supply this station, now nearly completed, involves the expenditure of $4,000,000 more. The cost of the proposed mammoth tunnel to extend to Oak Park from three miles out in the lake—almost $9,000,000—is not included in the fifteen-year total.

An improvement still in the promotional stage is that of Pershing road, estimated to cost about

$3,000,000, which is closely linked to the bridge building program of the Sanitary District. Within a short time the Sanitary district will award contracts on a $4,700,000 bridge building program. The contracts will cover the construction of two bridges spanning the main Sanitary canal, one at Crawford avenue and another at Cicero avenue. In addition, pier construction already is being pushed for the California avenue bridge and a contract is soon to be let for the superstructure and machinery.

Maryland Health Department Notes

The annual report for 1923 of Abel Wolman, chief engineer of the Bureau of Sanitary Engineering of the Maryland State Department of Health, contains a number of items of general interest to sanitary engineers and sanitary officials generally.

At Towson the first sewage treatment plant consisting of primary and secondary settling tanks of the Imhoff type and a trickling filter to be built in the state by county authorities was completed and placed in operation last year.

The construction of a bar screen and fine screen chambers at Hagerstown was started during the year by the Sewerage Commission, of which J. B. Ferguson is chief engineer. Mr. Wolman informs us that the screens were completed this year, are operating, and tanks for activated sludge treatment are under construction, although it has not yet been decided whether the type of aeration equipment will be the Manchester, Birmingham or Peck arrangement.

The attention of the Bureau was called to the pollution of Bodkin creek by wastes from the Sanitary Reduction Company's garbage reduction plant, which treats garbage collected in the city of Baltimore under private contract. The Bureau started negotiations with the company, as a result of which a fill consisting of considerable decomposing organic matter has been entirely covered to a depth of 7 feet by tailings and is being topped with cinders, thereby eliminating the odors and seepage. A chlorinator has been installed for deodorizing the gases from the dryer, which has materially reduced the disagreeable odors emanating therefrom. In addition, 8,000 cubic yards of material has been dredged from the shore line of the creek and dumped in open water below the plant, in order to remove the putrescing accumulation of past years.

To prevent the discharge of wastes into the creek, a screen was installed which removed from four to six tons of solid organic matter, but even after this installation the liquid wastes were objectionable and a chemical engineer employed by the Company recommended the following treatment:

"The waste will be diluted with hot water in the ratio of 1:3 and treated with sulphuric acid in a high speed agitator to change the grease from the colloidal to the separate form. The grease will then be skimmed off and the liquid discharged into a settling tank for treatment with iron and lime. The effluent from this secondary chemical treatment will then be discharged into the channel of Bodkin Creek in a stable condition with a light straw color. The precipitated material will be run through a filter press and returned for fertilizer tankage." The plant for carrying out this process has been completed and tests were about to be made at the time of our latest information.

Toledo Sewage Pumping

Some details concerning the pumping of sewage at Toledo, Ohio, are contained in the annual report for 1923 of S. A. Foster, commissioner of streets, which has just been made public.

The pumping equipment at the Bayview Park sewage pumping station consists of five motor-driven, single-stage centrifugal pumps, four with a capacity of 36 million gallons each in 24 hours and one of 24 million gallons. The operating force consists of four operators, one of whom acts as a relief operator, and three assistant operators. These work in three shifts of two men each, the relief operator relieving each of the operators and assistant operators one day of each week. From two to four laborers are employed as occasion requires.

This plant pumps at present only the flow in one branch of the intercepting sewer system. The sewage flow to the plant is at present, therefore, far below its capacity and the pumps are run intermittently, the sewer mains, which also have a capacity much greater than the present flow, being used for storage of the sewage while the pumps are idle. The sewage is allowed to accumulate until it rises about 13 feet above the level to which the pumps lower it. The pumps operate once and sometimes twice daily, averaging last year 10 hours and 14 minutes of pumping per day. The amount of sewage pumped and the rate of pumping are duly recorded by Simplex Venturi meters which are said by Mr. Foster to be giving very satisfactory service with very little trouble. The amount pumped per day averaged 5,891,000 gallons and the amount of electric current used totalled 281,260 kwh., which gives an average of 7,645 gallons per kwh. The maximum daily pumpage, on January 2, 1923, was 17,690,000 gallons, or about three times the average for the year; this large quantity being due to leakage from Ten Mile Creek, which had overflowed its banks, owing to a condition which has been remedied and will not occur again.

During the year there was removed from the screens, suction wells and skimming tank approximately 3,887 cubic feet of refuse, mostly mash, leaves, paper, rags and oil, or approximately 1.87 cubic feet to each million gallons of sewage pumped. This quantity was estimated by allowing 2 cubic feet for each wheelbarrow load. There was no method of disposing of the refuse other than to bury it upon the grounds, which is disagreeable, expensive and unsatisfactory, and Mr. Foster urges that as soon as pos-

sible an incinerator be provided or some other means of disposing of the screenings.

The records of amounts pumped indicate a large leakage of storm water into the interceptors, although the storm-water regulators seem to be doing all that is expected of them, and efforts are being made to locate the sewer or sewers responsible for this and remedy the defect.

Designing Imhoff Tanks

Discussion by John F. Skinner of the paper by Harrison P. Eddy, an abstract of which was published by us recently under the title "Comparative Study of Imhoff Tanks."

In connection with his discussion of Mr. Eddy's paper, John F. Skinner, deputy city engineer of Rochester, N. Y., gave some suggestions for designing Imhoff tanks. These were as follows:

DETERMINATION OF SLUDGE CAPACITY

The author suggests that "cubic feet per capita" is not the best basis for designing the capacity of an Imhoff Sludge Compartment. This again is another way of saying that each situation must be studied individually.

It is obvious that, by whatever method we arrive at the proper capacity for the sludge chamber, it is directly proportional to the population, and hence must ultimately be upon a per capita basis. It is equally obvious that it is directly proportional to the *quantity* of sewage per head per day, to the *suspended solids* and their proportion *removed* by sedimentation, and to the *number of days* in the period when sludge can not be drawn, due to weather conditions. It is also inversely proportional to the *solid content* of the sludge and is reduced directly by the amount of digestion during the cold period.

Attention is called to the following comparison of the four plants considered.

In determining the capacities of various parts of a tank we should first, for the particular set of conditions, design the sedimentation chamber for a desired per cent removal of suspended solids.

Having this figure and the total per capita suspended solids in the sewage and the length of period during which sludge cannot be drawn from the tank we may set up a general formula as follows:

D—Period, in days, when sludge cannot be drawn.

G—Gallons per head per day of sewage.

R—Per cent. removal expressed decimally.

S—P. p. m. suspended solids in sewage.

Q—Cu. ft. per capita sludge space required depending on per cent removal of suspended matter in sewage.

We have then (assuming sludge 90% water in tank and 25% reduction by settlement and digestion during the cold period).

$$Q - \frac{D\,G\,R\,S \times 10}{1{,}000{,}000 \times 7.5} \times 0.75 = \frac{D\,G\,R\,S}{1{,}000{,}000}$$

The above table makes an assumption in the 5th column which may be varied to suit given conditions of temperature, etc., which may affect the rapidity of digestion. The same is true of the 25% reduction assumed in the 8th and 9th columns.

With these adjustments (which may be readily made) kept in mind, the above formula is submitted as a convenient and flexible method of arriving at a reasonable solution of an important problem.

Like all determinations involving variables of unknown definite value, a reasonable factor of safety is to be commended and a careful comparison with existing plants.

AIDS TO PROPER FUNCTIONING

It is evident that the most careful operation cannot prevent foaming where the design is at fault or where the plant is overloaded, and also that careless operation may result in difficulties with the best designed plant.

It would seem that the prime requisite is a

Exhibiting Theoretical Comparison of Sludge Accumulation

Plant	Sewage, Flow in Gallons per capita per day	Suspended Solids: Parts per Million	Suspended Solids: Cu. ft. per Capita per month	Sludge, 90% water, cu. ft. per capita per month	4 months Collection cu. ft. per capita: 50% removal	4 months Collection cu. ft. per capita: 75% removal	Quantity after 25% Settlement and Digestion cu. ft.: 50% removal	Quantity after 25% Settlement and Digestion cu. ft.: 75% removal	Imhoff's Rule, Dr. Cu. ft. per capita
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Schenectady	92	163	.060	0.60	1.20	1.80	.90	1.35	
Plainfield	85	166	.056	0.56	1.12	1.68	.84	1.26	
Mean Sanitary	...	...	.058	0.58	1.16	1.74	.87	1.30	1.20
Fitchburg	89	219	.078	0.78	1.56	2.34	1.17	1.76	
Rochester	123	163	.080	0.80	1.60	2.40	1.20	1.80	
Mean Combined	...	...	.079	0.79	1.58	2.37	1.185	1.78	1.80

liberal and well balanced design and one which considers ease of operation.

The following points should be considered:

Design:

Gas Vents wide but not necessarily of large area.

Scum Chambers ample in width and freely connecting with gas vents.

Sludge Compartments of ample capacity and not more than three in line. With three, provide easy intercommunication. Provide ample means of agitating sludge with water jets.

Settling Chambers designed with relatively large area and shallow overflow. Provide for reversal of flow in the case of more than one sludge compartment.

Preliminary Treatment: Provide fine screens or fine racks and skimming chambers or deep scum boards, so that large objects and floating matter and scum may be kept out of the tank.

Operation:

Routine: Keep screens cleaned and floating matter skimmed. Drive down undigested material in gas vents and remove digested scum when it is a foot thick. Agitate sludge some time before drawing and during the winter if sludge capacity is not large. Reverse flow regularly, fortnightly or monthly, depending upon relative depth of sludge in different compartments.

Records should, of course, be kept of temperatures and quantities and all operations both physical and laboratory, and a journal should also be kept recording those conditions and occurrences not readily tabulated.

Quick Setting Concrete for Highway Paving

Special cement used in mixing concrete for road along a section of Connecticut state highway over which street cars ran eighteen hours after pouring.

By A. W. Bushell, M. Am. Soc. C. E.*

Early in the Summer of 1924 the Connecticut State Highway Department let a contract to the Bridgeport Construcion Company of Bridgeport, Conn., for constructing a reinforced-concrete pavement 36 feet wide and 9 inches deep on the Boston Post Road through the center of the town of Darien. The Connecticut Company runs trolleys over this road and its track was located along the side of the road over part of this contract. It was decided that a center location for the track would be preferable, and consequently a new track was laid on the center line of the new road while operation was maintained over the track on the side location.

After the concrete pavement had been laid along a sufficient length of the new track and set for at least seven days, the trolleys were

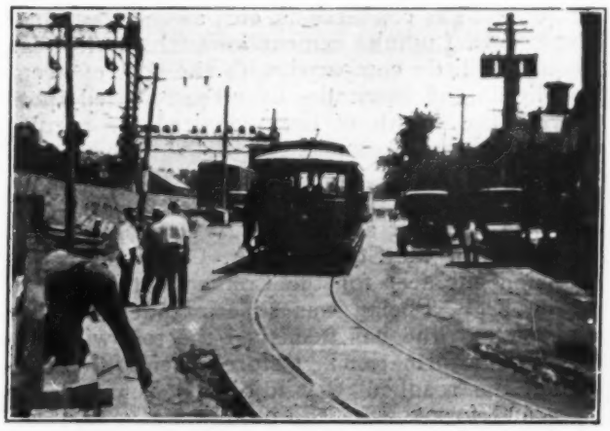
USING WOOD FLOATS ON DARIEN ROAD.

shifted over to the new track by temporary crossovers and the old track torn out and the space it had occupied was graded and concreted to form the new pavement. This procedure was repeated until a point was reached where the track left the pavement entirely and went down a side street, at which point the old rails had to

DARIEN ROAD, SHOWING NEW STREET RAILWAY TRACK.

be torn out and new rails installed in practically the old track location for a distance of 300 feet.

To concrete in this trolley area with regular Portland cement would have necessitated permitting the pavement to stand seven days before the cars could run over the track, thus causing the trolley company the expense of an extra



OPENED TO TRAFFIC EIGHTEEN HOURS AFTER PAVING.

*Div. Engr., Connecticut State Highway Commission.

car and travelers the trouble of transferring with a 300-foot walk between cars.

To obviate this difficulty it was decided to use "Lumnite" cement in place of Portland cement, as it was claimed by the manufacturers of the former that concrete made from it acquires, within twenty-four hours, the same strength as Portland cement concrete gains in twenty-eight days. The Atlas Cement Company, which manufactures Lumnite cement, sent a representative to see that the concrete was so laid as to get the most favorable results possible. The concrete mixer was entirely cleaned out so that no Portland cement remained on any of the blades of the mixer or in the skip. Exactly the same proportion of stone, sand and cement was used as for the rest of the pavement (a 1:2:3 mix), but considerably more water was used. To those who are used to the rather dry mix required by the Connecticut State Highway Department on road work, the mix looked decidedly sloppy and a test would have shown a slump of 4 inches or more.

During the pouring, the cable, which moves the trolley out on the boom of the mixer, broke and it was necessary to rig up a chute which handled the mix until the cable was repaired. The concrete made with the Lumnite cement handled exactly as well as concrete made with Portland cement. It took about the same length of time to get its initial set, the finishers stated that it worked as well, and it took a broomed finish which was satisfactory. Its color was much darker, but gradually lightened with age. However, it has never reached the light color of Portland cement concrete.

The roadway was opened to traffic, both vehicular and trolley, 18 hours after pouring and shows no bad effect of any kind to date. (This stretch was laid on July 18th, and Mr. Bushell's article was written on August 25th.)

The cost of Lumnite cement is approximately 2½ times that of Portland cement; but from the above experience and other similar experiences, it is felt that the use of it is justified wherever public convenience outweighs the additional expense of its use. One field for its use would be in making repairs to cuts in concrete roads for water and gas connections, etc., as the additional expense of Lumnite cement for such small areas would be little compared with the cost of keeping lights and barricades over the repaired spots during the length of time required for regular cement to set up sufficiently.

The writer of the above, A. W. Bushell, was division engineer and Robert Wier was resident engineer for the State, and A. L. Donnelly was division engineer for the Connecticut company, while R. E. Phelan was superintendent for the contractor, who has furnished the following additional information: Before placing the concrete, the roadbed, the adjoining concrete, the ties and forms were thoroughly wet. Concreting started about 2:15 P.M. on July 18th and was finished at 7 o'clock, the breaking-down of the mixer referred to by Mr. Bushell having caused a delay of about 1½ hours. After it had been laid about five hours the concrete showed signs of drying out and was kept wet by spraying until traffic was admitted the following day. The concrete was given a broomed finish and shortly after being thrown open to traffic the next day a 5-ton Mack truck loaded with concrete for another part of the job passed over this section without breaking up the broomed surface.

Illinois Road Work

According to the construction report issued by the State Division of Highways of Illinois, early in September, 796 miles of pavement have been completed on the Illinois highways so far this year. During the week ending September 4, 47.58 miles were completed, 105 paving mixers, 9,900 men and 2,475 teams having been employed that week on highway work.

Apparently the record for the year still remains as that of the week ending July 31, during which week 60.79 miles of pavement were constructed. Especially prominent this week was the record made by the W. C. Meneely Company between Decatur and Cairo, this company having laid 2,671 feet of standard 18-foot concrete pavement in one day with one mixer. During the week of July 31 the same company completed 10,405 feet of standard 18-foot pavement.

New Mexico Highway Notes

Bids on F. A. P. No. 129 were received on June 10th, contract formally awarded on June 11th, and on June 13th the contractor broke ground and started construction—believed to be a record in getting a project under way. This contract is for 4.28 miles of caliche in Chaves County. Armstrong & Armstrong is the contractor.

One of the features of road making in New Mexico that Eastern road engineers can hardly appreciate is suggested by the following reports from various jobs:

"Practically all quantities have been placed on this project, but there has been no moisture to compact the

TYPICAL CONCRETE GIRDER BRIDGE ON FEDERAL AID ROAD IN NEW MEXICO.

gravel surfacing. The contractor is dragging the road occasionally, but can do no further towards compaction until the rains set in."

"The contractor has found it necessary to sprinkle the sub-grade before placing the surfacing (gravel). A portion of the surfacing has been sprinkled and rolled, but this has not proven very satisfactory and it has been decided to discontinue the sprinkling and wait for rains before attempting to secure any compaction."

"During long dry periods, the subgrade, which is of a sandy nature, cuts very badly and it is with difficulty that it is maintained in condition to receive the surfacing."

"Finishing has been handicapped to a great extent by dry weather and until rain falls the contractor can make little progress towards getting the project in condition for final acceptance."

"This project now stands 100% complete insofar as quantities are concerned. The contractor finished placing the last of surfacing on May 20th, and has moved the screening plant and all other equipment from the project. A small crew has been left on the job to maintain the road and do the final blading and rolling after rain."

"The placing of plating over certain stretches, left rough by wind erosion, has continued throughout the period just ending."

"Rain is badly needed on the roads in this county, as the soil is of a sandy nature which tends to cut out in holes during dry, windy weather."

District Engineer W. C. Davidson says that roads should be built with a low crown "to reduce as much as possible the erosive action of high winds."

Contractors are not the only ones who condemn promiscuous bonding of unreliable contractors. G. C. Lassetter, project engineer on F. A. P. No. 77, says:

"This is one of the projects on which an unbalanced bid was turned in, the contractor having bit off a nice sizable job of hard rock for the gift price of $1.00 per yard. The project engineer's record shows that it has cost between $2.00 and $2.50 per yard to handle this stuff. This is also another case where a firm bid on a job which none of them had ever seen, and which represents in its worst phases the wild abandonment with which the surety companies rush to bond a contractor without investigating either the project or the contractor's prices."

Some interesting details of F. A. P. No. 102 (4.9 miles of concrete in Bernalillo County, New Mexico Construction Co., contractor) are given by J. A. Boulton, project engineer, as follows:

"The contractor elected to make this a central mixing job, expecting to do his hauling from the central plant with large units, mainly old Government Packards, Liberties and Velies of 3-ton capacity, and to that end he made considerable investment in steel dump bodies operated by hand power winches. He also provided a 7-ton Blaw-Knox steel turn-table capable of turning loaded 5-ton truck. This last mentioned piece of equipment is quite capable of handling the loads given by the manufacturers and probably 50% overload. At the eleventh hour the contractor abandoned the heavy unit idea and purchased a number of small units, Ford and Chevrolet 1-ton trucks with Anthony dump bodies. He made one or two experiments with the heavy units, the first time loading a Liberty truck with 3 yards mixed concrete. The truck and its load together must have weighed close to ten tons. It took this unit an hour and five minutes to go from the mixing plant to the unloading point on the subgrade; as a matter of fact it would never have reached there with its load if a 10-ton Holt tractor had not been rushed to its assistance. No difficulty was experienced in turning this tremendous load in the turntable, but it took seventeen men, two straw bosses, a superintendent and a general manager, one-half hour to unload the 3-yard content. Chains had been laid in the bottom of the bed, and it had been expected that five or six men could lay hold of these chains with a "yo-heave-ho" and yank the concrete onto the sub-grade. This system of dumping is quite satisfactory with one-yard trucks. Four men, two on each end of the chain can empty a one-yard truck in this manner in less time than it takes to tell it, but with the three-yard truck it was a different story, and the concrete was finally gotten out mainly by armstrong machine. It may be mentioned in passing that the concrete even after this lapse of time, and coming from the mixer with a slump of 1½ to 2, was in good workable condition when it was finally placed on the grade. It might be said too, that material with a slump of less than three-quarters of an inch is handled without trouble by the Lakewood tamping machine."

"American Wire & Steel Company triangle mesh of about 27 lbs. weight per square is being placed on certain designated sections of this project because of high elevation of the water table adjacent to these sections. The wire comes in rolls of about 4½ feet width and is cut to lengths of 17-feet 8-inches; each roll overlaps the preceding roll 4-inches, and wire is placed two inches below top of pavement. The contractor's method is to place a 4-inch layer of concrete, lay his reinforcement and cover it with another 2-inch concrete layer. This sounds simple enough, and would be so in practice if he had his paver on the subgrade. In that case he could lay a 4-inch slab for the full reach of chute or boom as the case might be, and then spread the two-inch layer on top of the reinforcement with very little hand work, and with practically as great speed as though the mesh were not there. With the concrete coming in batches of approximately a yard at a time and dumped in one pile, it must be spread by hand, and a large amount of labor is required.

"The practice now is to place about three widths of wire before top two inches of concrete is placed; this gives about twelve running feet of road by eighteen feet in width. When the wire mesh is laid, heavy canvas strips are placed on top of the reinforcement and the loaded trucks are backed on these strips as far back as it is desired to dump, in this way cutting labor of shoveling on the thin top course to a minimum. As soon as the trucks have been dumped and are gone, the canvas strips are pulled up, and the reinforcing (which is disturbed surprisingly little owing to the protection of the heavy canvas and the comparatively wide bearing area given the trucks by the pneumatic tires) is set back to its proper position."

Repairing Baltimore Pavements

The annual report of the Highways Engineer of Baltimore, Md., Bernard L. Crozier, for the year 1923 gives some interesting facts and figures concerning the repairing of streets in that city.

During the year $301,106 of materials, $600,251 of labor and teams and $119,464 of tools, equipment and gasoline were used in street repairs by city forces; while sheet asphalt repairs by agreement cost $172,736, and contracts for miscellaneous repairs and flushing amounted to $102,424. This gives a total of $1,295,982.

The unit costs of repairs made by city forces were as follows:

	Labor	Material	Total	
Vitrified brick	$1.18	$ .59	$1.77	per sq. yd.
Granite block	1.07	.48	1.55	" " "
Asphalt block	.78	.12	.90	" " "
Wood block	.92	1.24	2.16	" " "
Cold patching	.32	.51	.83	" " "
Bituminous macadam	.36	.72	1.08	" " "
Water-bound macadam	.15	.33	.48	" " "
Cobble	.66	.06	.72	" " "
Surfacing roads with T-70	.05	.05	.10	" " "
Spreading gravel	.06	.13	.19	" " "
Concrete base	1.44	.97	2.41	" " "
Cinders spread	.07	.14	.21	" " "
Cobble gutter	.20	.13	.33	" lin. ft.
Concrete curb	.51	.39	.90	" " "
Concrete gutter reset	.22	.14	.36	" " "
Stone curb	.05	.05	.10	" " "

Sheet asphalt repairs were made by agreement with three contractors, each being assigned one of the three districts into which the city was divided. This work included 1½-in. wearing surface, 1½-in. binder on a concrete base 6 in. thick, mixed 1:3:6. The price was $3.00 per square yard for base, including cutting out; $2.10 per square yard for surface and binder, and 25 cts. per square yard for additional binder ½ in. thick. Under this agreement the contractors laid 13,158 sq. yds. of base, 89,853 sq. yds. of surface and binder, and 72,630 sq. yds. of additional binder.

Contract for flushing with bitumen was let at 11.4 cts. per square yard for cold application at 1/3 gal., with cover; 8.9 cts. at ¼ gal., with cover; 5 cts. for cold application at ¼ gal., without cover, and 17.5 cts. for hot application with cover. This treatment was applied to 452,246 sq. yds. of roads in the outlying sections of the city.

Nearly 15,000 sq. yds. of cobble pavement in narrow streets and alleys was repaired or repaved at a cost of 64 cts. per square yard for taking up and relaying. The city paved 4,627 sq. yds. of alleys with cement concrete at a cost of $10,237, an average of $2.21 a square yard.

Street Cleaning in Fitchburg

In his annual report as commissioner of public works of Fitchburg, Mass., David A. Hartwell states that the cost for the year of cleaning streets and gutters, $23,487, may seem like a large item, but that it is to be borne in mind that a large territory is covered by pickup men continually throughout the open season and there is a general cleaning of the whole city in the Spring and again after the leaves drop in the Autumn. "The clean condition of our streets, especially our main lines of traffic, is a good advertisement in the minds of visitors to and travelers through our city."

Twenty-six horses were used by the street division and on a basis of 300 working days a year, the cost per horse per day was $2.53, which is 12c. less than the year previous, although still more than double the cost of 1916.

Any man who has worked for the Department an aggregate of at least 102 days in one calendar year is entitled to a vacation with pay the following year. During the year covered by the report the amount paid for vacations in the street and sewer divisions was $5,738.

Water Shortage in Salt Lake City

Salt Lake City was reported on August 28th to be threatened with a serious water shortage due to inadequate storage and the fact that the yield of the watershed was much less than the average, due to very low precipitation during the past twelve months. During January and February, when the snowfall in the canyons supplying the city is ordinarily very heavy, the precipitation was 55 to 62% below the average of previous years; while rainfall during the Spring and early Summer was 37% below normal. As a result, Twin Lakes reservoir was filled to only 73% of its capacity and Lake Phoebe Mary to only 68%. By the middle of August the total amount in storage was only 610 million gallons, or 71% of the total storage capacity, at a season of the year when the reservoirs should be practically full.

As soon as the supply became less than the consumption, the Water Department placed restrictions on lawn sprinkling, which were increased from time to time until by the end of August sprinkling was permitted only three hours a day for two days a week. Drinking fountains have been generally equipped with self-closing valves, and urgent appeals to save water have been made by means of placards and through the press, and sprinkling in the parks has been largely discontinued. Three inspectors are endeavoring to enforce Water Department regulations, assisted by one fireman from each station and other municipal employees. These measures reduced the consumption to 30 million gallons a day, or about 30% below the normal consumption.

It is estimated that 10% of the water in storage will be lost by evaporation and seepage. Winter drafts during the past five years have ranged from 146 million to 261 million gallons, and the minimum quantity which should be reserved for Winter use is estimated to be 200 million gallons. As the loss through evaporation and seepage will be about 61 million gallons, this leaves only 349 million gallons as the amount that can be drawn from storage during the balance of the Summer and Fall.

In order to further restrict the use of water, it has been proposed to absolutely prohibit all lawn sprinkling and to make a house-to-house inspection of plumbing fixtures. If vigorously carried out, either would undoubtedly reduce consumption to a safe amount.

The city has made plans by which metering of all service connections will be completed by December, 1925. Money has been made available by which the raising of Mountain Dell reservoir may be begun at once and it is hoped to complete it in time to impound the run-off next Spring. It is also proposed to build a large storage reservoir in Big Cottonwood Canyon, and surveys and borings have been made for a site for the dam.

Cost of Reservoir Fences

Figures of the cost of reservoir fences are not often available, and we, therefore, give a summary of bids received for furnishing and erecting fences along the Catskill aqueduct and the Scoharie reservoir, New York water supply, received on May 27th of this year.

The fence consists of reinforced concrete posts, including 121 gate posts; 1,583 end, corner and straining posts; and 6,313 line posts. These posts are connected with wire fencing of which 133,270 pounds will be required.

The bids for the gate posts varied from $5.63 to $15.18 each; the corner and straining posts from $3.18 to $9.42; the line posts from $1.50 to

$5.38; and the wire fencing from 12c. a pound to 24c. a pound.

In addition to these items, there was some earth and rock excavation and refilling, concrete masonry and reinforcing steel, and miscellaneous steel and iron. The largest item of all was the wire fencing. The total bids range from $100,228 to $192,040.

Adapting the City to the Automobile

Automobile manufacturer believes that traffic problem requires in each city a planning commission that can control city development, and transportation zoning.

By Alvan Macauley*

The result of the survey of traffic and street conditions in the cities of the United States recently published by PUBLIC WORKS reveals an astonishing situation. Those who have studied traffic problems have long known of their growing complexity but even the closest students would probably be surprised at the inadequacy of the remedies actually put into practice.

The outstanding fact revealed is that the important traffic streets of a large proportion of the 233 cities studied are inadequate for either the moving traffic or stationary vehicles which must use them. The engineers of some cities feel that this fundamental difficulty is due to the automobile; the engineers of more cities feel that the difficulty is due to the street and, fortunately, most feel that it is a problem which challenges their engineering skill and which must be solved.

There is no logical relation between the width of important streets and traffic use of them in the majority of the two hundred-odd cities and this situation is particularly true of the older and smaller cities. In less than a quarter of the cities are the business streets wider than the main thoroughfares; in three-eighths the business streets are equal in width to the main thoroughfares and in the remaining three-eighths the business streets are narrower. In most of the cities the streets are utterly inadequate to provide parking space where it is most needed. Already nearly a third of the cities have widened some of their streets in order to accommodate traffic, and in fully a half, traffic has become congested to such a degree that widening of streets involving enormous expenditures is now urgent.

What these conditions mean in accidents, transportation costs, cost of living, inconvenience, extra policing and many other economic and social burdens, cannot be estimated. These burdens comprise a congestion tax, which is borne by every citizen and which increases rapidly each year until it is further augmented by the cost of street widening. What are the cities doing to relieve themselves of these burdens?

It seems, in many ways, unfortunate that cities in this country became interested in city planning when they did—a little too early—a few years before the traffic problem became acute. If the interest in city planning had arisen simultaneously with the pressure of traffic congestion, the whole city planning movement would have been more powerful and more effective. Its inspiration would have been the city practical rather than the "city beautiful." And if it had not been that traffic regulation by policing was so simple and apparently successful in the earlier stages of the traffic problem, it would have been realized sooner that regulation is only a temporary palliative, not a cure.

These reasons are at least partially responsible for the fact that, while about half the cities report planning commissions, very few have taken these commissions and their plans with any degree of seriousness. They also account for the fact that, while about a third of the cities have made some study of traffic conditions, very few have used traffic studies in planning street layout, and only about a fifth have any kind of plan for future street development.

The city engineers who replied to the questionnaire named thirty or forty specific causes of traffic congestion and almost as many remedies. No doubt if their proposals were carried out, traffic congestion would in a number of cases be measurably relieved. Street widening, enlarging intersections, separating grades, lengthening curb radii at corners, removing obstructions to vision, better pavements, better maintenance—such remedies as these would certainly save hundreds of streets in the country from becoming intolerably congested. So also would regulatory measures such as the establishing of one-way streets, segregating different types of traffic, by-passing through traffic, prohibiting hazardous turns, signal systems and public education in traffic laws. So also would provision for parking—although the parking problem in the busier streets of the older cities is most difficult of solution because of the high land values which prevail.

But how inadequate such measures are, only the larger cities know. They discuss instead the need for more parallel through streets, for radial streets, for new streets connecting sections, for more rapid transit, for zoning, for limiting building heights, for decentralizing the population—for wholesale replanning and rebuilding, which probably are much nearer the fundamental needs. The smaller cities can still prevent the conditions which must otherwise be inevitable, by making full use of the experience gained by the larger cities. It is cheaper and easier to plan than replan, to build than to rebuild.

It might be said, with justice, that the development of the automobile was too rapid to be foreseen and adequate provision made. But how many cities have adequately foreseen, planned and provided for their growth in other ways be-

*President, Packard Motor Car Company.

sides automobile traffic To point out that the great majority of the cities have grown up without adequate vision or conscious guidance is commonplace. It is for this reason that the automobile industry and the automobile user should not be expected to accept responsibility for the existence of the present situation. But they certainly should and must accept partial responsibility for its relief.

With adequate funds and public support the city engineers of the larger cities could eliminate the most serious traffic difficulties—at least for some years. In the smaller cities they could probably prevent them altogether. The number and use of automobiles will undoubtedly continue to grow but probably all the general types of traffic congestion and their causes have already been or can be studied and solutions for them worked out. If he had the means and the power, the engineer of any city of any size and type could know what he faces in traffic problems and could prevent them to a considerable degree. This does not mean to infer that all that can be known of city planning and traffic control is known and that engineering skill has solved all the possible problems—there is still much to be learned and much to be solved. But much more would be learned and solved if it were not for the pervading sense of hopeless pessimism with which so many technical officials face their problems. While the country boasts (with justification) of its fifteen million automobiles as proof of happy prosperity, it should not forget that this prosperity requires intelligent control.

Citizens and their elected officials generally lag behind the municipal engineers in matters of city development—and, quite naturally, perhaps it will always be so, as the physical growth of a city generally precedes its civic growth. That is why the solution of many traffic problems is still in the thinking rather than in the acting stage. The city beautiful idea appealed to civic pride, it is true, but civic pride only infrequently arouses itself to more than lip service in the cause of civic beauty. Fortunately, however, all the economic interests of a city can be appealed to on its practical needs. Certainly the man in the automobile as well as the man in the street can understand the need of improving traffic conditions and a city plan on which to base such improvements.

Every city, large and small, needs a planning commission—with not only a planning function but also a realizing function. And on this commission there should be representatives of all the interests concerned—and men who can arouse such interests. Not only should the mayor, the council's head, the city engineer, the superintendent of streets and the police chief be active members, but so also should representatives of civic organizations, of automobile dealers and of automobile users. Public interest should be awakened and continuously maintained until adequate provision is made for correcting any conditions which cause trouble. When the engineer has worked out a plan to relieve congestion at some particular point that plan should be "sold" to the public—even to the point, if necessary, of having the traffic policemen at that particular point distribute explanations of the plan and petitions to all motorists inconvenienced.

In intelligent city planning and conscious control of city development lies the principal hope of preventing and ameliorating the traffic difficulties of the future.

Zoning must be organized not only with regard to use and to the comfort of the people but also with regard to the transportation necessities of the various sections. Zoning regulations have been devised and enforced to prevent the haphazard jumbling of various types of buildings and their uses—and they can also be made to prevent traffic concentration and mixing of different types of traffic. We know the social and economic relations between the zones and we therefore can know the traffic relations. We know that there will be a flow of traffic between residential and business, shopping and amusement centers at certain times of the day; between railroad and shipping terminals and manufacturing and wholesale distributing zones; and that there will be a constant flow of through traffic along the most convenient streets connecting with popular highways. All these needs can be, to a large extent, foreseen—and if there is a civic will, provided for.

If tall buildings and population congestion are a cause of traffic congestion, then building heights should be restricted. If certain zones become overgrown, subsidiary decentralized zones must be developed. Such control does not necessarily mean exercise of the police power of the municipality—enlightened cooperative citizen action can bring it about. The success of the "Save New York" movement in keeping manufacturing establishments out of the high class retail district demonstrates what can be done. The city can guide its growth in many ways without abusing its powers.

The traffic problem is, therefore, but a part of the larger civic problem of city planning. Knowledge, vision and will are needed—the first two can be provided by the engineer, the architect and the practical sociologist—the last can be provided only by the citizen.

Air-Lift Pumping at Hartford, Wis.

The five wells from which Hartford, Wis., obtains its water supply were formerly pumped by deep-well pumps, but have been changed over to air-lift. In sending us this information H. J. Peters, superintendent of the Utilities Department, explains this as follows: "We found that the maintenance of the deep-well pumps was too expensive and the operation too uncertain. When the consumption was greater than usual and all pumps were therefore operated continuously, one of them was pretty sure to develop some difficulty and go out of commission, causing trouble. Air-lift pumping may seem to be expensive, but it was the most reliable substitute for deep-well pumps that we could find."

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Large-Scale Water Purification, and Small

The filter plant now nearing completion at Buffalo, N. Y., with a capacity of 160 million gallons a day, will, we believe, be the largest plant in the world. It will, we suppose, be provided with all the refinements and conveniences, and be supervised by the best obtainable chemists and biologists, as is consistent with such an important plant. These will add to the construction and operating costs, but the added amount *per gallon* in such a large plant should be almost negligible, and may be more than offset by economies of operation they make possible. It is, in fact, unthinkable that a plant of this size should forego the added efficiency and certainty of operation secured by employing skilled technical operators.

But with a small plant the case is greatly different. The cost per gallon of refinements of construction and of expert supervision would mount very high. On the other hand, however, certain processes or operative features that would be impracticable for a large plant might be well adapted to a small one. For example, the United States Public Health Service reports that satisfactory treatment of drinking water on Great Lakes vessels is obtained by ultra-violet rays, ozone and distillation; methods that have recognized advantages (such as freedom of purified water from any added chemicals) but which it has not yet been found practicable to apply to large municipal plants.

Which is but another illustration of the fact that there is no one method of treatment that is "best" for all cases, but that size as well as character of water and other conditions must be considered in planning for each.

Handling Earth by Belt Conveyor

In the building of the Gilboa dam, as described in our issue of July 2, 1921, the contractor brought clay for an embankment from a hill 600 feet away and 250 feet higher by means of a belt conveyor. This method of handling earth seemed to us then sufficiently unusual to merit special description.

In this issue we describe certain features of the construction of the Wanaque dam, and the most striking of these is that earth for the embankment is being brought by belt conveyor a distance of 2,700 feet and lifted more than 50 feet above the level of excavation. Moreover, this one conveyor can transport nearly 2,000 cubic yards in eight hours.

To look at such a conveyor, one is not at first impressed with the work it is doing as a quantity performance. A stream of dirt flows past with a cross-section of only about 35 to 40 square inches. But, as in the case of a leaky faucet, it is the uninterrupted flow that produces the astonishing total. The belt moves at the rate of 400 feet a minute—that of a fast walk—or nearly 200,000 feet in eight hours; which gives 50,000 or more cubic feet moved in that time.

Another advantage is that, by building a small box tunnel—say 3 feet wide by 2 deep—just under the surface of a road or railroad, through which the belt can travel, these can be crossed without any interference to or from the traffic on them.

The use of such conveyors for carrying concrete aggregates and cement to a mixer has become common; but not so common is the conveying of the mixed concrete to the work and depositing it directly in place, which is what is to be done at the Wanaque dam.

The economy of such transportation is a most important point to be considered. In the above case, 50 horse-power is actually used to operate the several stages of the conveyor, or at the rate of 20 cubic yards carried one mile for each horse-power-day. The up-keep at present is negligible, and the depreciation seems to be so, also. A year's experience (including a few sleet and snow storms) should give actual data on this point.

The most remarkable development of the past five years of contracting has been the great variety and amount of appliances placed at the command of

contractors and used by most of them, and not the least interesting of these is the belt conveyor as adapted to handling excavated materials and concrete aggregates.

Annexing Water Distribution Systems

An ordinance passed by Toledo, Ohio, in July of this year provides that the city shall not furnish water to any territory outside the city limits unless the individuals or corporation controlling it shall agree that, in the event that this tract comes into the city, the city may take over the watermains without cost. Last year over $18,000 was paid for watermains in territory that was annexed to the city. As it is generally believed that subdividers charge lot purchasers a sum sufficient to cover the cost of the watermains in front of the property, they are doubly paid for these if the city should later, when the property is annexed to the city, pay them for these mains.

Investigating practices elsewhere previous to passing this ordinance, it was found that Nashville, Tenn. had passed a similar ordinance; Cleveland does not pay for watermains in annexed property unless a special agreement is made to this effect; Cincinnati does not generally make such payment. Detroit reports subdividers so anxious for annexation that they make no demand for payment for watermains, and no such payment has ever been made; and Rochester, N. Y. was the only one of the cities questioned that makes a practice of reimbursing subdividers for watermains in annexed territory.

Water Improvements at Knoxville

Improvements in the water supply of Knoxville, Tenn., are being made under the direction of Director of Public Service Alexander Harris and Frederick W. Albert, engineer in charge of the Water Department. Two old Worthington pumps have been completely overhauled, the sedimentation basins at the filtration plant have been placed in good condition and the Water Department is conducting a pitometer survey of the distribution system. During this survey a 3-inch and a 6-inch open connection between the low and high service were found, the closing of which reduced the high service pumping 1,200,000 gallons a day. A survey is being made of all gate valves and a card index of their locations is being prepared. About 200 public fire hydrants have been added and all of the hydrants have been thoroughly inspected and their condition greatly improved.

The engineer in charge of the Department is studying the plans for improvements submitted during the past few years by different consulting engineers and has submitted to the Director of Public Service a combination of these plans supplemented by his own recommendations. These plans call for a complete improved supply works and filtration plant to be erected adjacent to Williams creek and to have a daily capacity of 15 million gallons; the reconditioning of two standpipes and the erection of an additional elevated tank; the construction of a 30-inch supply main to the distribution system, and the addition of a number of gate valves and hydrants. It is planned to place the entire city on the high service except a small portion along either side of the river, which will continue to be supplied from the present low-service reservoir.

Garbage Incinerators in New York

An item with the above heading in our August issue stated that New York City has begun a program of incinerating its garbage, and has now in operation a 300-ton incinerator of the "Deane" type. The name given should have been "Decarie," a mistake that unfortunately escaped the notice of our proofreader. We hope that this correction will be seen by all who read the item referred to.

Sewage Works Managers' Associations

Bound Brook, N. J.,
September 4, 1924.

Editor Public Works:
Dear Sir:

With reference to your editorial in the August issue of Public Works entitled "Sewage Works Managers' Associations" may I state in the interest of accuracy that the New Jersey Sewage Works Association has a committee to take under advisement the question of changing the name to the "American Sewage Works Association" or such other name as will signify the inclusion of a larger field than the State of New Jersey, but that no decision has been reached.

The membership now includes eleven states and extends from Boston, Mass., to Berkeley, Calif. All are welcome regardless of the name.

We have tried to make this a Sewage Works Managers' Association. There are many trying obstacles such as attempting to keep the interest of every one from the political appointee with no interest in the technical side, to the trained chemist and engineer. Such a battle was on in the American Water Works Association when I joined it 18 years ago and is still going strong. The expense of transportation coupled with none too generous compensation is a matter of real concern in trying to keep up an association of works managers where the membership is so scattered as must be the case with sewage works men.

Inquiries by members of our committee have brought out many replies favorable to a national organization and many lukewarm. Some have felt that there is already a superfluity of national organizations with too great a burden of expense and have asked "What will it cost?" There has been no intention of raising the dues.

The New Jersey Association has certainly justified its existence in the one matter of establishing the New Jersey Sewage Experiment Station. That organization is already telling the definite answers to questions which have been matters of argument since sewage disposal began.

There certainly is need of an organization in which sewage disposal is the principal matter of discussion and not an appendage to some other branch of engineering or chemistry or biology.

A number of State organizations have been established since the New Jersey men set the example and it may be that local organizations with a central headquarters for culling and publishing available literature will offer the best solution of the matter.

All suggestions will be gladly received by the Secretary of the New Jersey Association and transmitted to the proper committee.

Very truly yours,
John R. Downes, Secretary.
N. J. Sewage Works Ass'n., Bound Brook, N. J

Modern Methods in Reservoir Building

Belt conveyors used for moving earth, aggregate, cement and concrete, over any distance and elevation desired. Removing thin topsoil at minimum cost at Wanaque Dam.

Two hundred thousand cubic yards and over of impervious material are needed on the up-stream or west side of the Wanaque Dam (being built for the North Jersey District Water Supply Commission; see PUBLIC WORKS for April 17th, 1920, August 27th, 1921 and May, 1923.) Such material is very scarce in that vicinity, and a large part of it must be obtained from 2,500 to 3,500 feet away, east of the dam and separated from it by a river, a railroad and a highway carrying a heavy automobile traffic. Besides crossing these, the material must be carried over the core wall and down-stream embankment, which had been built to a height of 25 feet above the original ground surface under a previous contract. In addition, the material is found only as a topsoil six to thirty inches deep (most of it twelve to eighteen inches). The problem of skimming off this soil and transporting it to the dam at a sufficiently rapid rate (about a thousand cubic yards a day was desired) and at minimum cost was presented to the contrctor and the engineers and apparently has been solved in the most satisfactory manner possible. The answer is—Elevating graders and belt conveyors.

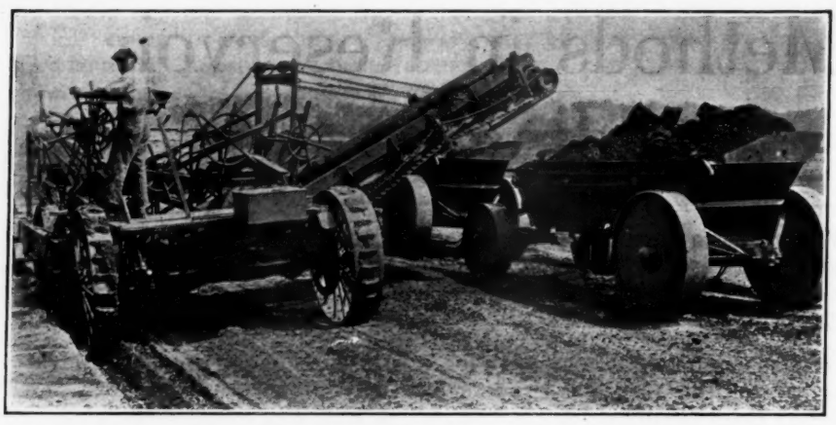
STRIPPING TOPSOIL

The topsoil used overlies a bed of gravel and sand, which is not to be mixed with this impervious material in the embankment. It was thinly covered with small trees and grass. The trees are removed, the grass and bushes cut off close, and the grass roots worked over by thorough plowing and harrowing, gang plows and wheel harrows being drawn by two Fordson tractors.

After this preparation, the soil is removed by an elevating grader (an Austin New Era Senior) drawn by a Holt 10-ton "Caterpillar" tractor, which delivers the dirt by belt conveyer in a continuous stream into 120 cubic feet bottom-dump trailers (LaPlant-Choate Mfg. Co.). A train of three of these is drawn by another Holt tractor, which keeps the last of them under the discharge from the grader until filled, then the second and finally the third. When the three trailers have

VIEW WEST OF WANAQUE DAM.

Machine shop and pump house in foreground. Gravel bank at right background. Impervious material being stripped from gravel at left background. Between gravel bank and machine shop, belt conveyor, with three transfer stations, for carrying gravel to concrete mixer which is located on a hill some distance to the left of the picture.

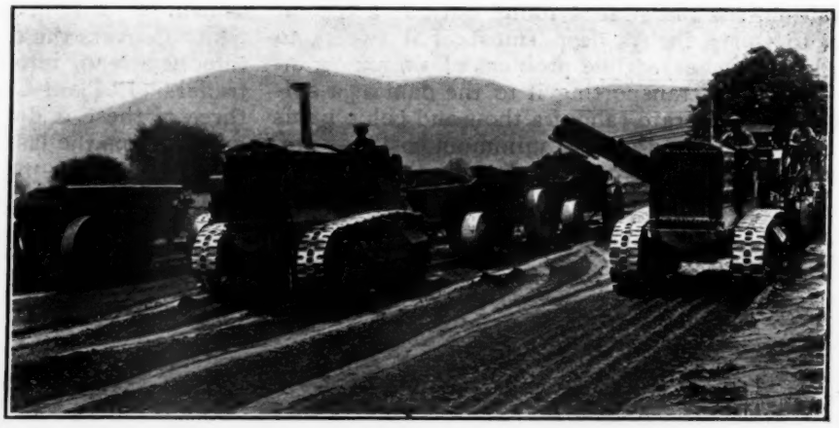


LOADING IMPERVIOUS MATERIAL INTO TRAILERS. REAR VIEW.

been filled, they are drawn to and up a ramp on to a dumping platform, where they are dumped into a hopper, and return for another load. Three caterpiller tractors, each hauling three 120 cubic feet trailers, keep the grader in continuous operation, except for a few seconds while one train is drawing away and another taking its place, and for the time taken (about two minutes) in turning the grader at the end of the field and starting back again.

One man operates each tractor and two operate the grader, or six men altogether; while at the dumping platform are three or four men dumping the trailers, keeping the platform clean and doing what is necessary to keep the dirt flowing continuously from the hopper onto the belt beneath.

This gang averages about 800 cubic yards of loose dirt a day; equivalent to about 700 yards of soil as it lies and to about 600 yards of embankment. When everything works without a hitch, double this amount is excavated, but there are occasional delays due to clogging of the grader or other interference with continuous operation; when working at the side of the field furthest from the dumping platform, the longer haul of course requires more time; and occasionally the discharge from the hopper to the conveyor is delayed by clogging or the conveyor may stop because of inability to handle the material as rapidly as it arrives at the dam.

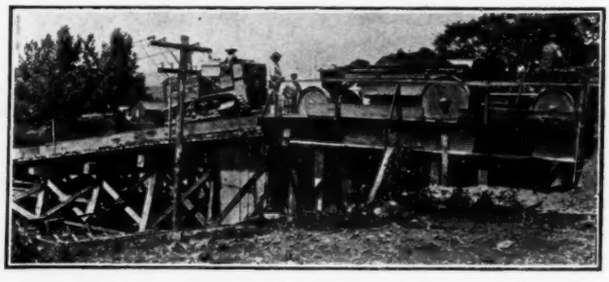


LOADING IMPERVIOUS MATERIAL INTO TRAILERS BY MEANS OF ELEVATING GRADER.

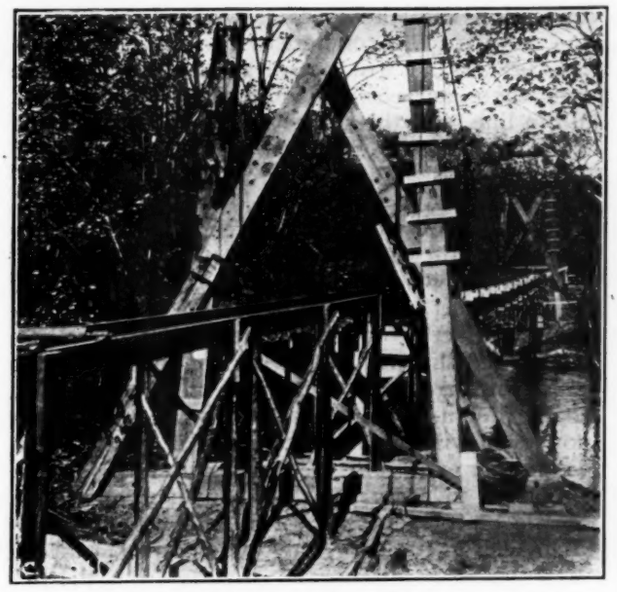
BELT CONVEYOR

The material is conveyed by a 20-inch belt running on rollers which are carried by a light trestle, the total distance transported by belt being 2,700 feet. The belt need not be level or at a uniform grade, and, in fact, is carried up inclines as steep as 20 degrees; it must, however, be perfectly straight. Where an angle in the line of the conveyor is necessary, this is made by ending one line of belt at this point where it dumps into a simple hopper which discharges on to a second line making any angle desired with the first. In this particular case, the line is broken into four tangents. At each transfer point the belt passes over a large pulley which operates as a drive pulley, the power for which is furnished by an electric motor. The rollers carrying the belt have ball bearings and need lubricating only about once a year.

The weight carried per running foot is not great, being that of only about one-quarter of a cubic foot of earth plus the weight of the belt itself, both the going and return belt, of course; to which is added the weight of the rollers. Workmen walking along the trestle in order to reach any point of the belt weigh considerably more than the belt itself and practically determine the strength of trestle necessary. As a matter of fact, the trestle in this case is constructed of two 2x8-inch plank on edge with 12-foot span between trestle bents, each bent being made of two posts cross braced together and to the adjoining bents. For posts were used cedar and other trees removed in clearing the land,



DUMPING IMPERVIOUS MATERIAL ONTO CONVEYOR
Specially driven receiving section of belt is immediately beneath platform where trailer is standing.



BRIDGE CARRYING BELT CONVEYOR ACROSS WANAQUE RIVER.

trees as small as 2 inches at the smaller end being found sufficiently strong.

At two points the conveyor crosses the river and here it is carried on suspension bridges made very simply of a frame tower at each end carrying two wire cables and wire suspension rods fastened to the flooring only by means of ordinary clips. No care was necessary to make the floor of the bridge perfectly level, and in fact there is more or less sag in each of the bridges, part of which will undoubtedly be taken up by temperature contraction when cold weather arrives.

Reference has been made to the highway and railroad across which the earth had to be carried. Advantage was taken of the fact that the river crosses under both of these at this point, and the conveyor was carried through the two culverts through which the river flows.

The pull which causes the travel of the belt is all exerted at one end, but in spite of this, the belt stretches very little in operation. There is a possible motion of 2 feet of the free pulley, allowing for a 4-foot stretch of the belt. Since operation it has been necessary, in the case of the longest belt, to reduce the length by two feet and it is not anticipated that any more shortening of the belt will be necessary.

Special construction was necessary at the two ends of the conveyor, where the dirt is discharged on to it and where it is discharged from it. At the former point a short length of belt travels underneath the hopper under the dumping platform, where the weight of a considerable mass of earth above presses down upon the belt. A motor is used for operating this length alone, and by means of a chain belt connecting the pulleys at the two ends of the conveyor belt, power is applied to it at both these points. When power was applied at one end only, difficulty was experienced in keeping belt in continuous operation.

At the other end of the conveyor the belt rises at an angle of about 20 degrees so as to carry the material over the concrete core wall, the upper end and the drive pulley and motor being supported on a tower. From here a chute carries the earth at an angle of about 45 degrees into two elevated hopper bins. At first a metal chute was used at this point, but, in spite of the considerable angle, it was found that the earth would not flow freely if at all damp and a belt conveyor about 50 feet long was placed in the chute. As very little power is required to operate it, it is driven by the same motor that drives the rising belt.

The belt travels at a rate of 400 feet a minute and the feed hopper is designed to feed earth to it at the rate of four cubic yards a minute. All of the power required for this line of conveyors is supplied by electric motors, about 50 horsepower actually being used for the entire line. Incidentally, it may be noted at this point that all of the power used throughout the reservoir, including several other belt conveyors, crusher, screens, concrete mixers, etc., is supplied by electricity, except only the three Erie steam shovels and the vehicular equipment such as trucks, tractors, etc. The conveyor system was furnished by the Conveying Weigher Company of Passaic, N. J., using belts made by the Manhattan Rubber Company.

DISTRIBUTING THE EARTH

The impervious material discharged into the hopper bins by the belt conveyor is distributed

LOADED CONVEYOR BELT CROSSING FLATS ON TRESTLE.

on the embankment by means of four 4-yard trucks. These are loaded in the ordinary manner by driving under the bin, a load being received in about fifty seconds. They then discharge the load wherever needed on the embankment. They are all self-dumping and the tailboard is fastened so that it can only partly open and, the truck traveling with the body in dumping position, the load is spread more or less as it is dumped. It is further spread by means of two graders (Wehr one-man graders are used) to a thickness of about six inches. Meantime a man with a wheelbarrow removes from the dumped material all roots or other vegetable matter of any size. After having been spread, the material is rolled with two Buffalo Springfield rollers having the front wheel grooved and the two rear wheels flat. A small street sprinkler wets down the rolled embankment just before new material is spread on it.

These four trucks distribute an average of about 800 cubic yards of impervious material a day. The two graders and two rollers spread and roll this material and also a somewhat smaller amount brought from another point west of the dam and about 1,500 to 2,000 feet distant, from which it is brought by 4-ton trucks, which are loaded by a grader of the same make as is used in the work already described.

The impervious material is being placed to a thickness of about four feet over the ground surface (which was first stripped of all organic and otherwise objectionable material) back as far as the toe of the embankment; also adjcent to the core wall out to a line having a 1:1 slope from the top of the bank. Outside of this 1:1 slope and above the 4-foot cover layer just mentioned, the embankment is made of earth, sand or gravel obtained wherever available, free from organic matter, large stones, etc., but not necessarily impervious.

OTHER USE OF BELT CONVEYORS

Belt conveyors will be used quite generally in connection with the concrete work also. Gravel and sand for the concrete will be brought by a conveyor over a distance of about 2,000 feet to a concrete mixer elevated on a tower on top of a hill in line with the center of the core wall of the main dam, the top of the tower being about 125 feet higher than the bank from which the gravel will be taken.

END OF CONVEYOR BELT AT DAM, WITH CHUTE, AND HOPPERS INTO WHICH IMPERVIOUS MATERIAL IS DISCHARGED FOR LOADING TRUCKS BY WHICH IT IS DISTRIBUTED.

Another conveyor will extend to this mixer from the railroad siding where the cement will be received, which conveyor will bring the cement in bags directly from the car to the cement storehouse adjacent to the mixer. Another short conveyor will carry the surplus of sand, resulting from the screening of the gravel as excavated, to the down-stream embankment. Still another conveyor will carry the concrete from the mixer to discharge it into the core wall forms. It is proposed to carry this last conveyor on a steel trestle built inside the forms and which will be imbedded in the core wall. This will permit the concrete to be discharged directly from the belt into position inside the forms without any additional handling. The structures for this work are nearing completion and we expect to give a description of this plant and process when it is in operation.

The belts used for placing the concrete will probably be used for placing the core wall of the Wolf Den dam also, the largest of the eight or nine dams which will be needed to confine the Wanaque reservoir in addition to the main dam across the river channel. Four of these dams are at what is known as Green Swamp, about two miles from the main dam. The Wolf Den dam will have a total length of about 2,300 feet and a maximum depth of about 45 feet.

The contractor for this work is Clifford F. MacEvoy of Newark, N. J. The work is in immediate charge of Supt. O. H. Kellogg. F. C. Sellnow is senior assistant engineer in charge of this contract for the commission. N. C. Holdredge is assistant chief engineer, Major Arthur H. Pratt chief engineer, and Morris R. Sherrerd consulting engineer of this and the other work being done by the North Jersey Water Supply Commission.

Traffic Beacons for Dayton

The city of Dayton, Ohio, has contracted for the installation of not less than 100 traffic beacons on the streets of the city. These are to be installed and operated by the American Gas Accumulator Company for a term of ten years without cost to the city, the company being permitted to place upon them "courtesy statements" or advertising cards on the lower half of each of the four sides of the beacon, giving the name of the person, firm or corporation financing the beacon. These advertisements must first be approved by the City Manager. The only other lettering that will appear will be such traffic signs or directions as may be ordered by the Director of Public Safety. The company assumes all responsibility in case of accident or damage suits resulting

from the beacons. The city may, if it choose, purchase the beacons outright at any time subsequent to eighteen months after installation at a price of $225 each less ten per cent. annual depreciation.

Separate Sludge Digestion

Experiences of twelve years at Birmingham, England. Dried sludge taken by manufacturers for use as fertilizer base. Eliminates grease and consumes nitrogen. Product inoffensive.

The experiences in sludge disposal by the digestion process at Birmingham, England were described in July before the Association of Managers of Sewage Disposal Works by John Watson, engineer of the Birmingham, Tane and Rea District Drainage Board. The principal points brought out by Mr. Watson are given below.

Change was made from the septic treatment of both sewage and sludge to the digestion of sludge in separate tanks in 1911. Thirty-nine tanks are used in the primary and secondary digestion employed in conditioning the sludge for the drying beds. The total tank capacity thus provided is 350,000 cubic yards, which represents approximately 6 1-2 months production of wet sludge, equal to a digestion period of five months under working conditions. Mr. Watson gave the capital value of the plant, including 150 acres of land, at 112,500 pounds, or about a half million dollars in American money.

Of the total tank capacity, 190,000 cubic yards are used for primary digestion and 160,000 for secondary digestion. Digestion in two stages has been employed since 1912, as it was found that vigorous fermentation was encouraged and tank space saved by dividing the digestion process into two stages. The sludge is transferred from a given sedimentation tank into the selected digestion tanks (generally five or six in number) by the main pumps. At the same time some of the ripest of the available sludge is pumped from a digestion tank into the same delivery main in the proportion of one part digested sludge to four parts fresh sludge, thus furnishing the latter with fermentative organisms as it enters the tank. This inoculation has been found by years of experience to have an excellent effect in reducing the digestion time required. In cold weather, steam is introduced into the delivery main from one of the boilers to raise the temperature more nearly to that most favorable to fermentation. The sludge during the past four years has had an average water content of 92.0 per cent. The dry solid matter has an average specific gravity of 1.50 per cent.

The rotted sludge or residuum of the fermentation process is pumped direct to the drying beds, which consist of half-acre plots of steam ashes, there being a total area of about 60 acres. Each bed is underdrained with 4-inch agricultural tiles laid in herringbone pattern and draining to a well, from which the effluent is pumped on to a percolating filter. Each drying bed is enclosed by earthen banks 2 feet high. The sludge is drawn on to the bed to a thickness of 18 inches and dries down to 6 or 7 inches. The time required for drying varies with the weather, but in the English climate it is not safe to assume more than two fillings per annum.

The whole area occupied by the digestion tanks is free from nuisance when working normally, although injunctions were obtained by residents of neighboring property when the practice of digging in sludge was in vogue. Mr. Watson said that it is not fully understood why sludge digestion tanks minimize smell, but this appears to be the case, the unstable products apparently passing out with the liquid sewage rather than remaining in suspension with the solids. He quoted Dr. Spillner as believing that much of the organic sulphur content of the sewage was to be found in the colloids and did not settle out. After studying many plants, some which gave off odors and some which did not, he held the view that foul smell from sludge digestion plants is the result of imperfect manipulation rather than the presence or absence of iron or any trade waste. Moreover, he believed that proper manipulation was possible without the employment of an experienced chemist continuously, although it is probable that the correct method of manipulation for each plant should be determined by experienced chemists and biologists.

The construction of digestion tanks need not involve great expense such as the construction of watertight walls, etc. Sludge of average density does not seep into an embankment like sewage, and some of the Birmingham tanks were made by enclosing the area with embankments of ashes. The crust or scum brought to the surface by gasses prevents any wave motion even when the wind is blowing and thus helps to prevent nuisance. Small tanks are better adapted to this process than large ones, the potential nuisance increasing with the size of the tank.

The sludge digested at Birmingham is delivered to contractors who store it in immense sheds on a 7-acre area, in which it is broken up and spread in thin layers. The sheds are open so that wind can blow through them for dying the sludge. When it is sufficiently dry it is ground into a fine meal and screened to eliminate all foreign substances. This meal makes an excellent base for fertilizer, the fine grinding increasing the rapidity with which the fertilizing properties can be assimilated. The contractors add sulphate of ammonia, bone phosphates and sulphate of potash. The fertilizer thus formed is then bagged for sale.

This method of treating sludge is not recommended as being by any means the cheapest, "but it effectually converts an exceedingly offensive colloidal mass of sewage into a dry substance which kept in one's office for years without giving off more odor than would garden soil in similar circumstances. It eliminates grease, it conserves the nitrogen, and it may on occasion be used as fuel." The present-day cost including both operating expenses and interest on construction cost is about 19c. per cubic yard of wet sludge with a water content of 92 per cent.

Street Mains Laid in 1923*

Tabulated from questionnaires filled out by nearly seven hundred superintendents and other officials of water works plants, eighty per cent of which are municipally owned and twenty per cent privately.

City	Cast Iron Mains: Under 6"	Cast Iron Mains: 6" 8" 10" & 12"	Cast Iron Mains: Larger than 12"	Steel Pipe: 12" or smaller	Steel Pipe: Larger than 12"	Other kinds	Size	Length, Ft.
New Jersey								
Bayonne	.....	4000-6 in. 5000-8 in.	300	.....	.....	.....	.....	.....
Bridgeton	2800	.....	3500-15 in.	.....	.....	.....	.....	.....
Cape May City	.....	½ mi.-6 in.	.....	.....	.....	.....	.....	.....
Edgewater	.....	500-6 in.	None	.....	.....	None	.....	.....
Egg Harbor	6000-4 & 6"	.....	.....	.....	.....	.....	.....	.....
Irvington	None	15,852-6 in. 166-8 in.	.....	None	None	None	.....	.....
Merchantville	296	41,983	None	None	None	.....	.....	.....
New Brunswick	.....	6925-6 in. 2193-8 in.	.....	.....	.....	.....	.....	.....
Phillipsburg	200-4 in.	1300-6 in.	.....	.....	.....	.....	.....	.....
Westfield	None	3 mi-6 in.	None	.....	.....	.....	.....	.....
New Mexico								
Albuquerque	1080-2 in. 2126-4 in. 7357-5 in.	20,588-6 in. 2357-8 in. 9600-10 in.	210-14 in.	None	None	.....	.....	.....
New York								
Auburn	400-4 in.	2000-6 in.	.....	.....	.....	.....	.....	.....
Avon	500	.....	.....	.....	.....	.....	.....	.....
Canton	2300	.....	.....	.....	.....	.....	.....	.....
Corning	.....	6591	None	None	None	None	.....	.....
Cortland	3500-4 in.	3000-6 in.	None	.....	.....	.....	.....	.....
Dansville	None	None	None	None	None	W. I.	2 in.	400
Elmira	None	10,193	None	None	None	W. I.	1½-1¼-2"	1817
Fairport	2000	20,000	4000	.....	.....	.....	.....	.....
Frankfort	None	300	None	None	None	None	.....	.....
Geneva	5000	1200-8 in.	.....	.....	.....	.....	.....	.....
Glens Falls	218	1,257	None	.....	.....	Galv. W. I.	.....	340
Herkimer	None	500 10-in.	None	None	None	None	.....	.....
Johnson City	12,650 4-in.	400 6-in.	.....	.....	.....	None	.....	.....
Le Roy	None	1,300	None	None	None	None	.....	.....
Little Falls	None	875	.....	.....	.....	.....	.....	.....
Malone	4,000	.....	.....	.....	.....	.....	.....	.....
Mechanicsville	None	700	None	None	None	None	.....	.....
Mohawk	100	None	None	None	None	None	.....	.....
Mt. Vernon	None	9,800	4,550	None	None	None	.....	.....
New York	.....	484,010	43,707	None	.....	Galv. Steel Steel C. I. subma.	2 in. 66-in. 72-in. 42-in.	25,800 7,900 36,390 8,342
Ogdensburg	32	2,386	.....	None	None	None	.....	.....
Oswego	None	3,500	.....	None	None	.....	.....	.....
Peekskill	500	4,600	None	None	None	None	.....	.....
Port Jervis	1,238	3,194	None	None	None	None	.....	.....
Scarsdale	None	3.46 mi.	None	None	None	None	.....	.....
Sidney	196	None	None	None	None	None	.....	.....
Solvay	2 mi.	None	None	None	None	None	.....	.....
Syracuse	790	25,718	None	None	None	None	.....	.....
Tarrytown	None	400	None	None	None	None	.....	.....
Waterford	1,750	370	None	None	None	None	.....	.....
Watertown	None	2,003	.....	2,003	.....	.....	.....	.....
North Carolina:								
Albemarle	.....	2 mi.	.....	.....	.....	.....	.....	.....
Gastonia	None	7,784	.....	None	None	None	.....	.....
Greensboro	400	18 mi.	480	None	.....	.....	.....	.....
Henderson	.....	30,000	.....	.....	.....	.....	.....	.....
Kings Mountain	None	21,880	2,201	None	None	None	.....	.....
Kinston	None	None	None	8,000	.....	.....	.....	.....
Mooresville	None	33,000	None	None	None	None	.....	.....
Newton	None	15,000	.....	None	None	.....	.....	.....
Spencer	1,900	None	None	None	None	None	.....	.....
Statesville	None	4,200	2,500	30,000	None	None	.....	.....
Wilmington	None	4,000	11,000	None	None	None	.....	.....
North Dakota:								
Fargo	None	18,942	827	None	None	.....	.....	.....
Mandan	3,500	.....	None	None	None	None	.....	.....
Wahpeton	1,500	.....	.....	.....	.....	None	.....	.....
Ohio:								
Akron	0.25 mi.	12.41 mi.	2.27 mi.	None	None	None	.....	.....
Athens	1,100	None	None	None	None	None	.....	.....
Barnesville	None	.....	None	2,000	None	None	.....	.....
Bedford	None	64,662	.....	.....	.....	.....	.....	.....
Cincinnati	3547	67,132	10,067	None	None	None	.....	.....
Conneaut	900	5,000	None	None	None	Galv.	1¼ to 3-in.	8,267
Coshocton	600	None	None	None	None	None	.....	.....
Dayton	576	20,593	414	None	None	None	.....	.....
Defiance	None	4,500	None	None	None	None	.....	.....
East Liverpool	1,100	.....	.....	.....	.....	.....	.....	.....
Eaton	None	400	None	None	None	None	.....	.....
Elyria	.....	800	300	.....	1½ mi.	.....	.....	.....
Findlay	664	None	None	None	None	.....	.....	.....
Tremont	1,500	900	None	None	None	None	.....	.....
Galion	500	300	None	None	None	None	.....	.....
Kent	.....	17,360	.....	.....	.....	.....	.....	.....
Lakewood	380	16,068	.....	None	None	None	.....	.....
Lancaster	4,330	.....	.....	1,200	.....	.....	.....	.....
Lorain	3,400	3,200	.....	.....	.....	.....	.....	.....

*Concluded from page 165.

City	Cast Iron Mains: Under 6"	6" 8" 10" & 12"	Larger than 12"	Steel Pipe: 12" or smaller	Larger than 12"	Other kinds	Size	Length, Ft.
Ohio (Continued)								
Medina	1,200	650	None	.....	.....	None	.....	.....
Miamisburg	1,150	7,596	.....	.....	.....	.....	.....	.....
Montpelier	None	None	None	None	None	Wr. iron	1 & 1½-in.	1,000
Niles	.....	2,877	400	.....	.....	Galv.	1¼-in.	500
Struthers	None	3,600	None	.....	.....	.....	.....	.....
Sidney	4,000	8,700	None	None	None	None	.....	.....
Tiffin	2,000	600	.....	None	None	None	.....	.....
Toledo	323	76,780	4,396	.....	.....	.....	.....	.....
Urbana	1,370	.....	.....	.....	.....	.....	.....	.....
Willoughby	None	2,500	None	None	None	None	.....	.....
Oklahoma:								
Ada	1,200	600	.....	.....	.....	.....	.....	.....
Clinton	None	.....	None	500	None	None	.....	.....
Guthrie	1½ mi.	None	None	600	.....	.....	.....	.....
Henryetta	3,000	3,500	None	.....	None	Galv.	2-in.	3,500
McAlester	3,000	210	.....	.....	.....	.....	.....	.....
Mangum	.....	.....	.....	1,000	.....	.....	.....	.....
Okmulgee	None	4,000	.....	None	.....	Galv.	2-in.	24,000
Stillwater	1,200	2,300	.....	.....	.....	.....	.....	.....
Walters	500	.....	.....	.....	.....	.....	.....	.....
Oregon:								
Albany	440	None	None	None	None	Wr. iron	4-in.	300
						Matheson	4-in.	150
						Wr. iron	2-in.	780
						Galv.	2-in.	1,100
Corvallis	.....	.....	.....	30,000	.....	None	.....	.....
Pennsylvania:								
Allentown	None	17,117	None	None	None	None	.....	.....
Ambler	1,969	136	.....	.....	.....	.....	.....	.....
Barnesboro	None	None	None	4,000	None	.....	.....	.....
Bellwood	800	.....	.....	.....	.....	.....	.....	.....
Carbondale	2,800	1½ mi.	1,400	None	None	.....	.....	.....
Connellsville	3,500	None	None	.....	.....	.....	.....	.....
Duquesne	500	2,300	.....	.....	.....	.....	.....	.....
Elizabeth	None	1 mi.	None	1,429	None	None	.....	.....
Franklin	.....	4,000	None	200	None	.....	.....	.....
Freeport	.....	None	None	None	None	Galv.	4 in.	800
Honesdale	400	2,300	.....	.....	.....	Galv. steel	.....	500
Huntingdon	100	.....	.....	.....	.....	.....	.....	400
Indiana	5,149	1,202	.....	.....	.....	Galv.	1 in.	3,859
						Galv.	¾ in.	273
Jersey Shore	None	None	None	1,000	None	.....	.....	.....
Johnsonburg	1,040	.....	.....	.....	.....	.....	.....	.....
Juniata	100	None	None	None	None	None	.....	.....
Kittanning	None	500	None	600	None	None	.....	.....
Lancaster	None	5,200	810	.....	.....	.....	.....	.....
Lebanon	None	14,124	.....	None	None	None	.....	.....
McDonald	None	300	.....	None	500	.....	.....	.....
Meadville	.....	1,208	.....	.....	.....	None	.....	.....
Meyersdale	1,000	.....	None	.....	.....	.....	2 in.	500
Norristown	2,000	6,000	None	.....	.....	None	.....	.....
Osceola Mills	.....	750	.....	.....	.....	W. I.	1½ in.	600
Pittsburgh	3,744	46,250	7,000	.....	.....	.....	.....	.....
Sayre	755	487	.....	.....	.....	.....	.....	.....
Shamokin	800	7,095	600	None	None	Brass	¾ to 1½ in.	600
Sharpsville	.....	1,500	.....	.....	.....	None	.....	.....
Susquehanna	None	None	None	None	None	W. I.	1½ & 2 in.	600
Titusville	None	2,600	1,700	None	None	.....	.....	.....
Uniontown	4,288	None	None	None	None	.....	.....	.....
Warren	None	1,400	None	None	None	Galv. W. I.	2 in.	4,500
Wellsboro	150	None	None	None	None	None	.....	.....
Windber	288	396	None	None	None	None	.....	.....
Rhode Island:								
East Providence	2,435	1,431	.....	1,589	.....	.....	.....	.....
Narragansett Pier	None	1,000	None	None	None	.....	.....	.....
Pascoag	None	None	None	800	None	None	.....	.....
Pawtucket	723	21,503	None	None	None	Galv.	2 in.	2,453
Providence	None	16,133	1,094	None	None	None	.....	.....
Woonsocket	None	2,200	None	None	None	None	.....	.....
South Carolina:								
Batesburg	.....	200	.....	.....	.....	.....	2 in.	1,000
Bennettsville	None	3,000	None	None	None	.....	.....	.....
Charleston	1,505	12,717	None	None	None	None	.....	.....
Columbia	None	5,963	None	7,010	None	.....	¾, 1, 1½ in.	13,287
Easley	.....	3,000	.....	.....	.....	.....	.....	.....
Florence	5,000	23,852	None	None	None	.....	.....	.....
Greenville	.....	2 mi.	.....	.....	.....	.....	.....	.....
Spartanburg	None	5 mi.	None	None	None	.....	.....	.....
South Dakota:								
Brookings	2,400	.....	.....	.....	.....	.....	.....	.....
Tennessee:								
Clarksville	1500	450	None	None	.....	Galv.	2 in.	2500
Dyersburg	None	2000	None	None	None	Galv.	1 in.	2000
Elizabethton	None	None	None	.....	.....		¾ in.	2000
Erwin	3000	None	None	None	None	.....	.....	.....
Fayetteville	None	250	None	None	None	Galv.	4 in.	400
						Galv.	3 in.	4100
Harriman	1½ mi.	.....	.....	.....	.....	.....	.....	.....
Jackson	200	14,000	None	None	None	Galv.	2 in.	2½ mi.
Memphis	400	140,611	18,013	None	None	None	.....	.....
Murfreesboro	600	6000	.....	3000	.....	.....	.....	.....
Newport	.....	7500	.....	.....	.....	.....	.....	.....
Paris	None	None	None	1000	None	None	.....	.....
Shelbyville	2 mi.	1 mi.	None	None	None	Galv.	1 & 2 in.	15,000
Tallahoma	1200	1400	.....	.....	.....	Galv.	1½ in.	1250
Texas:								
Cameron	600	1800	.....	.....	.....	.....	.....	.....
El Paso	.....	5000	3000	.....	.....	.....	.....	.....
Ennis	3⅓ mi.	.....	.....	3⅓ mi.	.....	.....	.....	.....

City	Cast Iron Mains: Under 6"	6" 8" 10" & 12"	Larger than 12"	Steel Pipe: 12" or smaller	Larger than 12"	Other kinds	Size	Length, Ft.
Texas (Continued)								
Galveston	None	None	100	None	None	Concr.	.....	3500
Graham	None	None	None	None	None	Galv.	2 in.	2 mi.
Lockhart	None	None	None	None	None	Galv.	.....	4000
McKinney	None	None	None	600	None	Galv.	.....	600
Marlin	None	21,500	372	None	None	None	.....	.....
Mart	3000	None	None	None	None	None	.....	.....
Memphis	3500	None	None	None	None	None	.....	.....
Port Arthur	5000	20,000	.....	.....	.....	.....	.....	.....
Quanah	.....	41,000	.....	.....	.....	.....	.....	.....
Sweetwater	600	5300	.....	.....	.....	.....	.....	.....
Yoakum	None	3000	None	None	None	None	.....	.....
Utah:								
Logan City	None	None	None	None	None	Galv.	2 in.	1200
Murray City	None	.....	.....	300	None	.....	2 in.	1000
Salt Lake City	13,560	.....	.....	.....	.....	.....	.....	.....
Tooele	None	None	None	150	None	Vit. clay Wood-stave	10 in. 4 in.	650 700
Vermont:								
Barton	60	None	None	None	None	None	.....	.....
Bennington	3500	1000	.....	.....	.....	.....	.....	.....
Brattleboro	900	2300	None	.....	.....	.....	.....	.....
Windsor	700	3500	.....	.....	.....	.....	.....	.....
Virginia:								
Clifton Forge	2400	800	None	1000	None	.....	.....	.....
Martinsville	2600	7000	None	None	None	None	.....	.....
Norfolk	11,108	30,772	20,558	None	None	None	.....	.....
Richmond	1294	62,595	5347	.....	.....	Galv.	2 in.	11,614
Washington								
Aberdeen	1000	3600	7400	8000	None	Wood	6 in.	8000
Anacortes	.....	.....	.....	.....	.....	Wood-stave Wood-stave	8 in. 6 in.	12,522 4326
Auburn	2000	600	.....	.....	.....	None	.....	.....
Centralia	650	1650	.....	None	None	Wood-stave Wood-stave Wood-stave	4 in. 6 in. 8 in.	4250 5700 825
Hoquiam	2019	6636	.....	.....	.....	Galv. Galv. Galv.	1½ in. 1¼ in. ¾ in.	320 2798 347
Raymond	.....	1100	.....	.....	.....	Wood Wood	6 in. 8 in.	500 1000
Sedro Wooley & Burlington	None	.....	.....	None	.....	Wood-stave	.....	4268
Spokane	None	11617	None	None	427	Kalamein Kalamein Galv. Galv.	8 in. 12 in. 1½ in. 2 in.	1320 330 583 729
Tacoma	None	1400	11,960	None	1141	Wood, wire wound	6 & 8 in.	Small amts.
Walla Walla	.....	.....	.....	.....	.....	.....	Under 6 in. 6, 8, 10, 12 in.	3000 6707
West Virginia								
Beckley	None	None	None	1600	None	None	.....	.....
Martinsburg	None	700	None	600	None	None	.....	.....
Morgantown	2 mi.	1 mi.	.....	.....	.....	.....	.....	.....
Welch	2000	6150	.....	None	None	None	.....	.....
Weston	3000	.....	.....	.....	.....	.....	2 in.	500
Wisconsin								
Appleton	1227	12976	None	None	None	.....	.....	.....
Baraboo	.....	1230	.....	.....	.....	.....	.....	.....
Beaver Dam	.....	750	.....	.....	.....	W. I.	2 in.	1500
Chippewa Falls	900	300	.....	.....	.....	.....	.....	.....
Clintonville	600	1300	None	None	None	None	.....	.....
Cudahy	None	1500	None	None	None	.....	.....	.....
Edgerton	500	None	.....	None	None	None	.....	.....
Hartford	500	.....	.....	None	.....	None	.....	.....
Janesville	311	15,100	1769	None	None	None	.....	.....
Jefferson	1210	112	None	None	None	None	.....	.....
Kaukauna	None	5187	None	None	None	None	.....	.....
Kenosha	None	27,452	3310	None	None	None	.....	.....
La Crosse	1944	4561	.....	.....	.....	.....	.....	.....
Ladysmith	220	None	None	.....	.....	Galv.	2 in.	400
Madison	None	11,658	None	None	.....	None	.....	.....
Manitowoc	None	6500	.....	None	None	None	.....	.....
Marinette	1354	4366	None	3805	.....	.....	.....	.....
Menasha	1584	6709	.....	.....	.....	.....	.....	.....
Menominee	600	.....	.....	None	None	.....	.....	.....
Merrill	414	1017	None	None	None	None	.....	.....
Milwaukee	.....	1850	.....	.....	.....	.....	2 in.	1500
Monroe	None	55,956	6640	None	None	None	.....	.....
Neenah	None	4300	None	None	None	None	.....	.....
Racine	None	3303	72	4611	72	None	.....	.....
Reedsburg	.....	260	.....	.....	.....	.....	.....	.....
Rhinelander	200	100	.....	.....	.....	.....	.....	.....
Ripon	600	None	None	None	None	None	.....	.....
Shewano	2000	None	None	None	None	None	.....	.....
Shorewood	None	100 tons	75	None	None	None	.....	.....
South Milwaukee	None	2350	None	None	None	None	.....	.....
Sparta	4000	.....	.....	.....	.....	.....	.....	.....
Sturgeon Bay	None	2400	None	None	None	None	.....	.....
Superior	None	3036	None	None	None	Galv.	2 in.	764
Watertown	1041	3408	.....	.....	.....	.....	.....	.....
Wausau	None	5460	540	None	None			
Wauwatosa	None	2 mi.	None	None	None	None	.....	.....
West Bend	None	168	None	None	None	None	.....	.....
Whitewater	400	.....	.....	.....	.....	None	.....	.....
Wisconsin Rapids	465	3728	None	None	None	None	.....	.....
Wyoming								
Cheyenne	2804	7287	None	None	None	None	.....	.....
Evanston	400	None	None	None	None	None	.....	.....
Laramie	600	None	None	None	None	None	.....	.....
Rock Springs	800	1600	None	None	None	None	.....	.....

Recent Legal Decisions

CHANGING FROM FLAT RATES TO METER RATES—ECONOMIES EFFECTED

The Pennsylvania Public Service Commission, in a water meter rate case, Borough of Wyomissing v. Sinking Spring Water Company, December 26, 1923, says: It has been a generally accepted theory in rate making for water companies that metered rates should reflect some measure of the economies and efficiencies which metered service undoubtedly effects in comparison to flat rate service. The inducement to consumers to transfer from flat rate to metered service which results in conservation of supply and greater efficiency in distribution, should not be withheld by making meter rates so high as to preclude such a change, beneficial alike to the consumer and the company.

LEASE OF PUBLIC UTILITY PLANT BY MUNICIPALITY TO AN INDIVIDUAL

The Indiana Public Service Commission holds that it has no jurisdiction to approve the cancellation of a lease by a town of public utility property (in this case a light and power plant, with its distributing system) to an individual for a term of years. This is a matter entirely for the parties by mutual consent, and if they cannot agree, then whatever question arises is one for the courts. Town of Hagerstown v. Cass.

REGRESSIVE FEATURE OF WATER RATE SCHEDULE FOUND DISCRIMINATORY

The Wisconsin Railroad Commission, at the request of the utility, revised the schedule of rates of the Plymouth City Water Works, so as to eliminate the regressive feature of the existing schedule, which was found to be unjustly discriminatory. Instead of charging all consumers alike for the first 300 gallons used per day, for example, the utility charged a consumer who used 295 gallons per day 36 cents per 1,000 gallons, but a consumer whose use amounted to 305 gallons per day was charged 30 cents per 1,000 gallons for the entire amount instead of 36 cents per 1,000 gallons for the first 300 gallons per day. The result of this was to enable a consumer to use a larger amount of water at a total cost less than the cost of a smaller amount.

POWER MUST BE CLEARLY GIVEN TO MUNICIPALITY TO FIX UTILITY RATES FOR PERIOD OF FRANCHISE

Powers granted by a state legislature to a municipality to provide for water supply and light carries with it the power to grant a franchise to an electric company for a limited period to use the municipal streets for poles and wires and the transmission of electricity, and the franchise, if accepted, becomes binding upon both the city and the company, not to be revoked or repealed, unless the power to repeal has been clearly and unmistakably reserved. But the power to provide lights for a city does not include the power to enter into a binding contract, whereby the rates to be charged by a public utility corporation shall be irrevocably fixed. To enable it to make such a contract the legislative authority to the municipality must clearly and unmistakably appear. An act of the Alaska legislature giving municipal corporations authority to provide for fire protection, water supply and lighting was held not to give the municipality power to enter into a binding contract with an electric company to which it had granted a franchise, fixing rates during the 50-year term of the franchise. Alaska Electric Light & Power Co. (C.C.A.), 294 Fed. 864.

CITY WITH LICENSE TO LAY PIPE LINE ENTITLED TO NOTICE AND TIME FOR ITS REMOVAL

The California courts hold, City of Vallejo v. Burrill, 221 Pac. 676, that a municipal corporation owning and operating its own water system, which has entered the premises of a land owner as a licensee for consideration and after paying such consideration has expended a considerable sum in laying and maintaining its 6,000 feet of pipe, owned an irrevocable license or at least a license subject to revocation only on notice with reasonable time allowed for the removal of its property. The pipe line, it was held, did not become a fixture and part and parcel of the lands.

ORDER FOR INSTALLATION OF WATER METER AND SETTLING BASIN HELD VOID

The Washington statute requires all grievances to be inquired into by the Department of Public Works to be plainly set forth in the complaint. Where a complaint merely raised the question of defective distribution of water in a city, the Washington Supreme Court held, North Pacific Public Service Co. v. Kuykendall, 219 Pac. 834, that it did not present the question of the necessity for meters and a settling basin, and, there being no evidence on the subject, an order requiring the installation of a meter system and settling basin by the water company was void.

ENTRY ON PRIVATE LANDS TO BORE FOR WATER WITHOUT CONDEMNATION PROCEEDINGS HELD DEPRIVATION OF PROPERTY

The California Supreme Court holds, Jacobsen v. Superior Court, 219 Pac. 986, that a municipal water district cannot in advance of condemnation proceedings enter upon private lands with a force of employees and equipment for the purpose of making test borings at various points, occupying land for purposes of ingress and egress, fencing the test holes and other excavations, and trampling down growing grain, as such acts would constitute an interference with the owner's exclusive rights of property in violation of the state and federal Constitutions.

WATER PIPE LINE HELD NOT ABANDONED BY CITY BY NONUSER

The California Supreme Court holds, City of Vallejo v. Scally, 219 Pac. 63, that a city which had acquired an easement for a right of way for a water pipe line did not lose by abandonment its title either to the right of way or the pipe line, so as to prevent the removal of the pipe line as personal property, where the only evidence of abandonment pointed out was the nonuser of the pipe line, the establishment of a new pipe line, and the abandonment of certain portions of the old line, rendering it unlikely that the old line would ever be re-established as a conduit for water.

REMOVAL AND REPLACEMENT OF WATER MAINS

A municipal corporation is vested with authority under its police power reasonably to regulate the use of its streets and other ways by public service corporations acting under franchise from the municipality. The West Virginia Supreme Court of Appeals, State ex rel. Benwood v. Benwood & McMechem Water Co., 120 S. E. 918, granted a peremptory writ of mandamus requiring a water company to remove and replace a water main for the reason that "the street in question is a busy thoroughfare; that the pipe line, on account of its long use and continuous strain, is subject to frequent breaks and leaks; that a part of it lies diagonally across the street; and that it would at least require great care in restoring the street, in event of its disturbance, resulting from the repairing of breaks or leaks in the pipe lines."

ZONING ORDINANCE FORBIDDING CHEMICAL FACTORIES HELD CONSTITUTIONAL

The New Jersey Supreme Court holds, Franklin Contracting Co. v. Deter, 122 Atl. 600, that an ordinance forbidding the erection of chemical factories in a specified zone area is clearly directed against potential nuisances, and is designed to promote the public health, and is therefore within the powers conferred by New Jersey Laws of 1920, chapter 240, upon which the ordinance rests, and in that respect and to that extent is constitutional.

PROVISION IN ROAD WORK CONTRACT MAKING COUNTY ENGINEER SOLE ARBITER

A provision of a road construction contract that the county engineer "shall determine the amount, quality, fitness and acceptability of all work to be paid for, and decide all questions or differences of opinion that might arise as to the interpretation of these plans and specifications, or the fulfillment of the terms of this contract," is held by the Circuit Court of Appeals, Fifth Circuit, in Bay County, Fla., v. Nixon-Smith Const. Co., 294 Fed. 898, to constitute the county engineer the final arbiter of the amount due the contractor under the contract. In an action on the contract the only questions to be submitted to the jury would be as to the competency and good faith of the engineer.

CONTRACT BETWEEN CITY AND COUNTY BY WHICH COUNTY IS TO CONTRACT FOR PAVING CERTAIN CITY STREETS

The Georgia Supreme Court holds, Mayor, etc., of Washington v. Faver, 117 S. E. 653, that a city council authorized by the city charter to pave the streets was not required to make a direct contract with some one for such paving, but could make a contract with a county by which the county was to contract for the paving. Where a city contracts with a county for the pavement of certain of its streets, which are links in interconnecting county seat roads, one half of the cost of which is to be paid for with funds to be furnished by the general government through the state highway department; and the other half to be paid for by assessments on property abutting upon such streets, the city agreeing to pay any balance of this half of such cost not obtainable from such assessments from the general funds of the city to be raised during the year, this does not amount to the creation of a debt, a violation of article 7, § 7, par. 1, of the Constitution of the State of Georgia.

MEANING OF "PAVING" STREET

Under a provision of a city charter authorizing street paving and apportionment of the expense between the city and abutting owners, the North Carolina Supreme Court holds, Board of Comrs. of City of Hendersonville v. Freeze, 117 S. E. 498, that the word "pave" as used in the statute means more than laying the stone base and covering it with asphalt. As a comprehensive term it implies all things necessary to and immediately connected with the construction of a firm, convenient and suitable surface for the use of horses, vehicles and pedestrians, including the necessary preparation, such as engineering and grading, as well as putting down the stone or brick or other surface material, and thereby completing the work in the way intended for the public use, and such items would be chargeable in an assessment of an abutting owner.

ROAD CONTRACTOR'S CLAIMS FOR ADDITIONAL COMPENSATION SUSTAINED

The New York Court of Claims, Cazsier Const. Co. v. State, 121 Misc. (N. Y.) 704, 202 N. Y. Supp. 179, sustained a claim by a road contractor against the state for work performed in tearing out a portion of the foundaton course which had become rutted during the progress of the work, and relaying the same, under the direction of the state engineer, where the damage was caused by quicksand and clay in the roadbed. The contract called for the placing of No. 2 and No. 4 stone; and where the contractor was prevented from so doing and compelled to place small quarry stone upon the roadway first, which was not provided for in the contract, and then afterwards to place the No. 2 and No. 4 stone above this, a claim therefor was sustained although not covered by a supplemental contract under the Highway Law, not being a case where there was any increase in quantity, or extra work performed, or extra material furnished.